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THE
NATURAL HISTORY
OF
INSECTS,

COMPILED FROM
SWAMMERDAM, BROOKES, GOLDSMITH, &c.

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INTENDED AS A COMPANION TO

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C O N T E N T S.

	<i>Page</i>
INTRODUCTION.	1
OF Insects in general	7
Of Insects of the Beetle kind	11
Of four winged Insects	50
CHAP. I.	10
CHAP. II.	10
CHAP. III.	10
CHAP. IV.	10
Of Insects with Membranaceous Wings, and reticulated with Veins	57
CHAP. V.	10
Of mealy winged Insects, with a spiral Mouth	65
CHAP. VI.	10
Of flying Insects with four membranaceous wings	85
CHAP. VII.	10
Of Insects of the Bee or Wasp kind, with Stings in their Tails	89
CHAP. VIII.	10
A more particular account of Bees and their management	105
CHAP. IX.	10
Of Insects of the Ant kind	119
CHAP. X.	10
Of Ants, from Goldsmith	123
CHAP. XI.	10
Of flying Insects with two Wings	127
CHAP. XII.	10
Of the Gnat and Tipula	139
CHAP. XIII.	10
Of Flies of the Gnat kind, which have slender Snouts or Trunks like Threads	140
CHAP. XIV.	10
Of flying Insects of the Tipula kind	144
CHAP.	145

CONTENTS.

CHAP. XV.	
Of Caterpillars, and Butterflies proceeding therefrom	146
CHAP. XVI.	
Of Insects of the Spider kind	178
CHAP. XVII.	
Of Scorpions, Centipes, Gally Worms, and Hog-Lice	187
CHAP. XVIII.	
Of Fleas, Lice, and other Insects	193
CHAP. XIX.	
Of Worms with naked Bodies without Limbs	201
CHAP. XX.	
Of Shell Snails.	207

INTRODUCTION.

INTRODUCTION.

THOSE animals which by their size chiefly attract our attention, are but the smallest part of animated nature; the whole earth swarms with living beings, every plant, every grain and leaf, supports the life of thousands. Vegetables seem, at first sight, to be the parts of organized nature, which are produced in the greatest abundance; but upon minuter inspection we shall find each supporting numberless minute creatures, who fill up the various gradations of youth, vigour, and old age, in the space of a few days existence.

Vegetables are generally produced but once in a season; but among insects, especially of the smaller kinds, a single summer suffices for several generations. These therefore would multiply in greater abundance than the plants on which they subsist, but that they are destroyed by other animals, and often by each other; the spider feeds on the fly, the birds upon the spiders, and they, in turn, make the food of man and every beast of prey.

Some insects as to their conformation are composed of several rings, joined together by a membrane, which is the usual form of the body in grubs, worms, and caterpillars. Unlike birds, who traverse the air with such rapidity, these humble animals, seemingly less favourites of nature, move forward but slowly. The whole body consists of a chain of annular muscles, whose orbicular fibres being contracted, render one of the rings that was before ample and dilated narrow and long. The fibres of these rings are found to be spiral, as are their motions in a great measure, so that by this means they can the better bore their passage into the earth. Their crawling motion may be explained by a wire wound round a walking cane, which when slipt off, and attempted to be lengthened, has an elastic contraction of one ring to the other. In like manner the earthworm, having shot out or extended its body, lays hold upon some substance with its small feet, and so brings onward the hinder part of its body.

Caterpillars have feet both before and behind, which not only enable them to move forward by a sort of steps made by their fore and hinder parts, but also climb up vegetables, and to stretch themselves out from the boughs and stalks to reach food at a distance. Behind, their broad palms are beset almost round with sharp small nails, to hold and grasp whatever they are upon; likewise before, their feet are sharp and hooked, by which they can lay hold of leaves, while their hinder parts are brought up thereto. Reptiles that have many feet may be observed to move them regularly one after another, and from one end of the body to another, in such a manner that their legs in walking make a sort of undulation; and by this means they move much swifter forward than one would imagine. The motion of snails is performed in a different manner; they have a broad skin along each side of the belly, which

INTRODUCTION.

has an undulating motion, which, with the help of the slime that covers their bodies, they can move slowly forward, and adhere to every surface at pleasure.

The second sort of insects are flies of various kinds, whose bodies are covered by small plates not unlike our ancient armour, the pieces of which are lengthened by unfolding, and shortened by running over each other. These lead a more luxurious life, transfer themselves from place to place with rapidity, and spend their little existence in feasting and propagating their kind.

The third sort are ants, spiders, and others, whose bodies are divided into two or three portions, joined by a sort of ligament. Of all the race of reptiles these seem to be endowed with the greatest share of sagacity. The wisdom of the ant, and its well formed commonwealth, is too well known to be insisted on; but the spider, though it leads a solitary and rapacious life, seems endowed with even superior instincts. Its various artifices to ensnare its prey, and, when no longer able to supply a new web itself, the stratagems it lays to get possession of that belonging to another, are evidences of its cunning.

The minuteness of insects may render them contemptible in the eyes of the unthinking; but when we consider the art and mechanism in so minute a structure, the fluids circulating in vessels so small as to escape the sight, the beauty of their wings and covering, and the manner in which each is adapted for procuring its peculiar pleasures, we shall find how little difference there is between the great and little things of this life, since the Maker of all, has bestowed the same contrivance in the formation of the elephant and the ant.

The structure of the eye in insects is remarkably different from that of other creatures in several respects. It is defended by its own hardness against external injuries, and its cornea, or outer coat, is all over divided into lenticular facets, and through the microscope appears as a beautiful piece of lattice work. Each hole in this is of such a nature, that when looked through, every object seems inverted. This mechanism alone supplies the place of the crystalline humour, which is not to be found in insects. Spiders have generally eight eyes, and flies may be said to have as many as there are perforations in the cornea. Other creatures are obliged to turn their eyes different ways to behold objects, but flies have them so contrived as to take in every object near them at once. In order to keep their eyes clean, they are provided with two antennæ, or feelers. Some however are of opinion, that they clean their eyes with their fore legs as well as the feelers; nor is this conjecture ill founded, when we consider, that in some sorts, particularly the flesh fly, the feelers are too short for this purpose, and therefore their legs alone can supply the defect.

The mechanism in the feet of flies, and other insects, deserves also our notice. The amphibious insects, which are obliged to live by land as well as water, have their hindmost legs made with commodious flat joints, having gristles on each side serving for oars to swim with, and placed at the extremity of the limb; but nearer the body there are two stiff supporters to enable them to walk when they have occasion. In those insects whose motions are performed by leaping, such as the grasshopper and cricket, their thighs are strong and brawny; those, on the contrary, which use their claws in perforating the earth, have such parts.

parts made with strength and sharpness, as in the wild bee, and the beetle. There are even some animals that convey themselves by methods to us unknown. Insects, which are generated in stagnant waters, are often found in new pits and ponds, and sometimes on the tops of houses and steeples. Spiders with their webs have been known to soar to a considerable height, having been seen above the highest steeple of *York Minster*. How these animals have been thus capable of conveying themselves from place to place is a phænomenon for which we are unable to account; some years ago, it was the method to give reasons for every appearance in nature, but as philosophy grows more mature it becomes more cautious and diffident, nor blushes in many instances to avow its ignorance.

Those insects which are provided with wings have tendons, which distend and strengthen them; those which are provided with four, use the outermost rather as cases to defend the internal wings than as instruments in flying. When the insect is at rest, the inner wings are generally gathered up in the manner we close a fan, nor is it without some efforts that the little animal can unfold it. Those, however, whose wings are not cased in this manner, such as moths and butterflies, have them defended with feathers; for that beautiful variety of colours which we so much admire, appears, through a microscope, to be nothing more than different coloured plumage, as artfully placed as in the wings of birds, but too minute to be discerned by the naked eye. Such insects as have but two wings have two little balls, or poiuers, joined to the body under the hinder part of each wing, that serve to keep them steady, and in some measure counteracts the changes of the air, which might at every variation carry them in its current: If one of these poiuers be cut off the insect will soon fall to the ground, but if they are both cut, it will still fly, but yet in the direction of every breeze.

They are thus formed for motion, rather to provide sustenance than to avoid danger. As from their natural weakness they are the prey of every superior order of animals, they seem to find safety only in their minutenes of retirement; but even with every precaution they furnish out a repast to swallows and other birds, who, while to us they seem sporting in the air, are then employed in procuring their necessary subsistence. The insect itself, however, is at the same time in pursuit of some inferior order of insects, for there are the same hostilities among the smallest that there are amongst the largest animals.

Summer is the season of their pleasures; many of them never live above a single season, while others are found to continue but one day. Such however as are more long lived, take the proper precautions to provide for their safety in winter, and fix upon the most convenient situations for spending that interval, and such as want food lay in the proper stores for subsistence. But the greatest number want no such necessary stock, for they sleep during the continuance of the winter. Some caterpillars, for instance, having fed during the summer retire, at the approach of cold, to a place of safety, and there, by spinning a thread like a cobweb, hang themselves in some commodious place, covered with a factitious coat, which at once serves to keep them warm, and guard them from external injuries. Here they continue in this torpid state till the returning sun calls them to new life;

they now expand new wings, and become butterflies, which seem scarce employed in any other manner than that of reproducing their kinds. Thus we see among insects those different offices of eating, sleeping, and generation make different seasons in their lives. Were we to compare them with other animals, we should find, that while those pursue such pleasures by frequent returns, these experience each but once in their lives, and die.

There are some insects, however, which lay up provisions for the winter, of which the bee and the foreign ant are remarkable instances. The wasp, the hornet, and the wild bee are not less assiduous in laying in a proper stock of food, and fitting up commodious apartments; but this is wholly for the sake of their young, for they forsake their nests in winter, leave their young furnished with every convenience, and retire themselves to other places, where, in all probability, they live without eating.

In general, all insects are equally careful for posterity, and find out proper places wherein to lay their eggs, that, when they are hatched and produce young ones, there may be sufficient food to maintain them; whether they chuse trees, plants, or animal substances, still the parent creature finds a bed which at once supplies food and protection. The plum and the pea, each seem to give birth to insects peculiarly formed for residing in them. The pear and apple produce a white moth; on the oak leaf are hatched several of beautiful colours, white, green, yellow, brown, and variegated. The manner in which those insects lay their eggs is sufficiently curious; they wound the leaf through, and then deposite their eggs in the little cavity. As the insect increases, its nidus or bed, increases also, so that we often see the leaves of trees with round swellings on the surface, upon opening of which we may discover numberless insects not yet come to maturity. On oak trees these nests appear like little buds, and are in fact only gems, or buds, which are increased in thickness when they ought to have been pushed out in length. The insect thrusts one or more eggs into the very heart of the gem which begins to be turgid in June, and but for this would have shot out in July. This egg soon becomes a maggot, that eats itself a small cell in the midst of the bud, the vegetation of which being thus obstructed, the sap designed to nourish it is diverted to the remaining parts of the bud, which are only scaly integuments that by this means grow large, and become a covering to the case in which the insect lies. But not only the oak, but the willow, and some other trees and plants, have knobs thus formed, which generally grow in or near the rib of the leaf. Among these cases formed by insects, the aleppo galls may be reckoned as the most useful, the insects of which, when come to maturity, gnaw their way out, as may be seen by the little holes in every nut. But all these are formed by the ichneumon kinds of flies, namely, of those kinds which are vulgarly called the blue bottle fly.

Those kinds, however, which do not wound the leaf, take great pains to lay their eggs on the surface, in the exactest and most curious manner. When thus deposited, they are always fastened thereto with a glue, and constantly at the same end. Those which lay them in the waters, place them in beautiful rows, and generally in a fizy substance, to prevent their being carried away with the motion of the water.

Upon

Upon posts, and on the sides of windows in country villages, little round eggs have been seen resembling pearls, which produced small hairy caterpillars, and those like the rest are all laid in very regular order. The gnat, though so very small, is yet very curious in the manner of depositing her eggs, or spawn. It lays them on the water, but fixes them to some floating substance by means of a stalk, which prevents them from sinking. The eggs are contained in a sort of transparent jelly, and very neatly laid; when hatched by the warmth of the season, they sink to the bottom, where they become small maggots, stick to the stones, and provide themselves cases, or cells, which they creep into or go out of at pleasure, and thus continue till they take the usual change into that of a fly. Most of these insects are tinged with one principal colour, resembling either that of the leaves on which they subsist, or the branches to which they fasten; on these they march with great slowness, and by this artifice are confounded with what they subsist upon, so as to escape the birds, their rapacious and watchful enemies. Such is the manner with those insects which being hatched from eggs, are then transformed into caterpillars, which may be called their eating state; after that wrapped round with a covering of their own fabrication, and thus turned into nymphæ, which may be called their sleeping state; and lastly furnished with wings, and metamorphosed into butterflies, which is their generating state.

But there are numberless other insects which are brought forth alive, such as the spider, and the snail produced with a shell, which grows with its growth, and is never found to forsake it. These are never seen to change, but continue their growth: the spider, as it becomes older, has its legs longer, and if they be cut off, like those of the lobster they grow out afresh. The snail, as it becomes more old, acquires additional ringlets to its shell, and contains in itself both sexes. But there is an animal lately discovered, whose powers of generation are still more extraordinary than any thing hitherto taken notice of, and from the phenomena attending which, Mr *Buffon* has ventured to affirm, that he still believes there may be such a thing as equivocal generation. The animal in question is called the polypus, a small reptile found on aquatic plants, and in muddy ditches. This surprizing creature, though cut into never so many parts, still continues to live in every division, and each, in less than three days, becomes in every respect a perfect polypus, like that which was at first divided. This I think may be justly esteemed the lowest of animated beings, and scarce to be ranked above the sensitive plant, except by being endowed with a locomotive faculty, or a power of moving from one leaf to another. It is thus that Nature chuses to mix the kinds of being by imperceptible gradation, so that it becomes hard to determine where animals end, or vegetables begin. In this there are evident marks of her wisdom in filling up every chasm in the great scale of being, so that no possible existence may be wanting in her universal plan. Were we to ask, why these minute creatures, in general little regarded by man, except from the prejudice they are of to his labours, where formed in such great abundance, it would be no easy task to find a reply. For man's use they were not made, as they are allowed to be noxious to him; nor for the sustenance of other animals that may be of use to him, since the advantages of the latter

cannot

INTRODUCTION.

cannot compensate for damage done by the former ; perhaps the wisest answer would be, that every creature was formed for itself, and each allowed to seize as great a quantity of happiness from the universal stock, as was consistent with the universal plan ; thus each was formed to make the happiness of each ; the weak of the strong, and the strong of the weak, but still in proportion to every order, power of conquest and enjoyment. Thus we shall find, that though man may be reciprocally useful to other animals, yet in some measure they were formed for his use, because he has been endowed with every power of rendering them subservient, and enjoying their submission.

NATURAL.

NATURAL HISTORY

OF

I N S E C T S.

C H A P. I.

Of Insects in general.

AN Insect is a small animal, either composed of several rings joined together by a membrane, or several small plates, which play one over another, or else having a body consisting of two or three parts, joined together by a sort of thread or string. The first kind, we commonly call Worms or Grubs; as also, Caterpillars. When they advance from one place to another, they stretch the muscular skin, which separates the first ring from those that follow, and thrust it forwards to a certain distance; then they contract and wrinkle the skin on the same side, bringing forwards the second ring, and so on; and thus they can move along without feet, proceed out of the earth, and enter into it again without any danger; besides, they can proceed in this manner backward or forward as they please. The second sort are flies of various kinds, whose bodies are an assemblage of small plates, which are lengthened by unfolding, and shortened by running over each other, much in the same manner as some parts of the ancient armour. The third sort are Ants, Spiders, and many others, whose bodies are divided into two or three portions, which seem to have but a small relation to each other.

Their smallness renders them contemptible in the eyes of the generality; but rather should be a reason for admiring the art and mechanism of their structure, which contains so many vessels, fluids, and motions in creatures so minute as almost to escape the sight; such as mites, and the like. Some of these insects are richly adorned, with robes of various colours, such as blue, green, red, gold and silver, and many other embellishments. We need only look upon shining flies, Cantharides, Butterflies and Caterpillars to be convinced of this truth. The same wisdom which has given these ornaments, has armed them from head to foot, and has enabled them to fight, and to defend themselves; though they do not always catch what they lie in wait for, or shun what is hurtful; yet they are provided with what will best serve them for those purposes. Some of them have strong teeth, others a double jaw, or a sting, or strong claws; and they have shelly armour, that cover the whole body. The most delicate are furnished with hair, which serves them to break the shocks they may receive, and to weaken the blows, or to preserve them from the rubs that might hurt them.

They

They are almost all very quick in their flight, and getting out of the way of danger ; some by the help of their wings, and others by the assistance of threads, which they can throw out, and hang by them under the leaves of trees, on which they live. Others again can leap to a great distance, and so get out of harm's way.

It is also wonderful to consider the various organs by which they are assisted to live, and the instruments they make use of each according to their profession. Some are skilful in spinning, having two distaffs and fingers to draw out the thread ; others can make nets and webs, and are provided with thread and shuttles. Some again build themselves houses with wood, and have the sickles to cut it ; others are skilful in making way, and have scrapers, spoons, and trowels. They have generally a trunk, whose uses are more wonderful than that of the elephant ; for with it they can extract liquor with more skill than any man. Some have tongues, which serve them for tasting, and others have a sort of gimblet to bore holes with. Others have piercers fixed to their tails, by means of which, they make lodgings for themselves and families, in the heart of fruits, under the bark of trees, and even in the hardest wood. Most of them have excellent eyes ; besides which, they have horns or feelers, to prevent their meeting with any thing that may do them harm, especially in the dark. Some of these horns are full of knots, or joints, like those on the heads of Cray fish ; and several are terminated like a comb. Others again have four large wings, equal to the length of their bodies, and some have them so fine, that the least obstacle will tear them in pieces ; but these are generally hid under two strong shells, which may be raised up, or shut close down, which they always are, when they are at rest or creep. Besides these, there are other great varieties, which will be taken notice of in their proper places.

All sorts of insects are generated like larger animals, from eggs ; and these at first are enclofed in a single or double covering, which opens when the animal is old enough to pierce through. When the brood break the covering, at their coming into the world, these creatures are said to be viviparous ; as for instance, Millipedes, or Hog-lice. When the old ones bring forth the young in a covering, where they are to remain some time, they are said to be Oviparous. All these insects, and indeed, all sorts of animals are brought into the world one of these ways ; and those of the oviparous kind, always lay their eggs in a proper place, where they are hatched by a certain degree of heat.

It was formerly the common opinion, that all sorts of insects proceeded from corruption ; but this has been exploded long ago, especially since the invention of Microscopes. And indeed, it would be absurd to suppose, that these animals which are perfect in their kind, should be the effect of chance. The motions of these creatures, may seem to us without any design ; and yet, it is certain that they tend to a certain end, even those of the smallest, as well as the largest. No insect abandons its eggs to chance ; for they are never mistaken in laying them in places, where they may receive proper nourishment, as soon as they are hatched. In those countries where Silk Worms naturally live, you will always find their eggs on a mulberry-tree, and nowhere else, which plainly shews they know what they are about. The Caterpillars that feed upon cabbages, are never found upon willows,

nor those of willow upon cabbages. The moths delights to be among curtains, woollen stuffs, or papers, but never upon plants, nor in mud, nor yet in corrupted aliments ; and yet the contrary happens to flies, who lay their eggs in flesh ; and therefore, it is plain, it is instinct, and not chance that directs their choice. That this does not arise from the corruption of the flesh is plain, from the following experiment ; take a bit of beef fresh killed, and put it into an open vessel, another into a clean one covered over with a piece of silk, so thin as to let in the air, and yet thick enough to hinder the eggs of the fly from passing through it, and you will find the first bit produce maggots as usual, whereas the second will be entirely without ; however, the flies being attracted by the smell, will come in crowds to the covering, and endeavour to enter in, and perhaps lay some of their eggs upon the silk, but they will penetrate no farther ; from whence it is plain, that corruption produces nothing.

When some of these eggs are hatched, the young will appear in their perfect form, which they never change afterwards. Thus, snails come into the world with their houses on their backs, and continue always in the same shape, as well as that of the houses ; for they grow in proportion to the animal itself. Such likewise are Spiders, which proceed from their eggs completely formed, and change nothing afterwards but their sizes. But the greatest part of other insects pass through different states, and assume successively the figure of two or three animals which have no resemblance to each other.

Many insects when they proceed from their eggs, appear to be nothing else but a sort of worms, some without feet and others with ; those without feet are under the care of their dams, which supply them with food, if they are not hatched in a place where they find nourishment. Those with feet, go of their own accord to search for food on the leaves of the tree, that is most suitable to their nature, which is the very same where the dams laid their eggs. These grow sensible in a short time, and some of them throw off their old covering five or six times, and seem to grow young again, by having a new skin. These all pass through the middle state, which is that of a Nymph or Chrysalis ; but this wants explanation. The Caterpillar first leaves off feeding, and incloses itself in a sort of coffin, which is different in the different kinds. This covering preserves them from external injuries, till they acquire a new form. These have the name of Nymphs, and then they assume all the beautiful colours which adorn the various kinds. Some then call it an Aurelia, or Golden Nymph, because the covering which is more or less hard, assumes a colour as shining as gold. Some call this covering a Cod, especially when it is applied to a Silk-Worm.

The last state or metamorphosis, is when they arise out of their coffin, and become flying insects ; for that which was a worm before is destroyed, or rather turns into a fly. There are some insects that live only upon greens, and others that feed on nothing but wood. It is now generally believed, that there is another sort which are nourished even in stones themselves ; however, it is more certain, that there are many which never appear out of the water. There are reckoned no less than three hundred kinds of Caterpillars which are already known, and the curious are still making new discoveries : their shape, their colour, their inclinations, and their manner of living, distinguishes the

several sorts from each other; and yet they are all perfect in their kinds. However they are all composed of several rings, which being either extended or contracted, enable them to carry their bodies where ever they have occasion to go. They have a certain number of feet with joints, and are armed with hooks, wherewith they fix themselves to the barks of trees, especially when they sleep, which is the time they pass from one state to the other. They have almost all threads composed of a fluid gummy matter, which they get out of the leaves that supply them with food. When they perceive any danger of being carried off by birds, or crushed by the motions of the branches, they fix themselves to the trees by means of this gum, which is made into threads by several openings of their bodies, which threads they unite with their paws, and form several into one, capable of supporting their own weight, and so are generally secure from danger. Some naturalists believe, that the colour of the Caterpillars is one of the best preservatives against the birds that are fond of feeding upon them; for they generally are of the same principal colour as the leaves whereon they feed, or of the small branches to which they are fixed, when they undergo the metamorphosis; thus, those that are nourished on the buckthorn-tree are as green as the leaves thereof, and those that live upon apple-trees and bushes are of the same colour as the bark of those plants. Even the smallest of those animals have methods of screening themselves from the pursuit of the birds; for they may be often found under the leaves and not above, where they would be more exposed.

All sorts of Caterpillars use a particular kind of nourishment, which they never change upon any account whatever; for though they live upon greens, each has its own plant, and will sooner die than feed upon any other, unless they are nearly of the same. Towards the end of the summer, when Caterpillars have sufficiently fed on the green leaves, then they leave off eating, and secure a retreat, where they undergo the succeeding changes. A few days are sufficient for some to undergo this metamorphosis, while others continue months, and even years in their coffins. Some at this time hide themselves in the ground, and others get upon the roofs of houses, in the holes of walls, under the bark of trees, and even into the heart of the wood; others again, wrap themselves up in threads and gum, and rowling themselves in the sand, make themselves a sort of stone coffins. Likewise, some reduce little bits of wood to powder, and with their gum make a covering in which they wrap themselves; and when it is quite formed, it is not much unlike an *Egyptian* mummy.

Some sorts of Caterpillars are capable of spinning threads, in which they are covered and defended from the rain, particularly Silk-worms, of which more hereafter. The most common sort of Caterpillars are those that we meet with on elms, apple-trees, and bushes; and the Butterflies that proceed from them, fix upon some entire leaf, where they lay their eggs in the autumn, and die soon after; but before winter they are hatched and become small Caterpillars, which with their threads make themselves beds and spacious lodgings, where they lie during the cold season, distributed as it were in different rooms without eating, or coming out. Their coverings are as hard as parchment, and consequently sufficient to keep off the rain, wind, and cold; for they lie upon a sort of thick down, and are surrounded with several fillets.

fillets of the stuff wherewith they build their lodgings. Thus, having given some account of insects in general, we shall now proceed to particulars.

C H A P. II.

OF INSECTS OF THE BEETLE KIND.

THE Beetle is a flying insect, with a case over its wings to defend them from danger when it does not fly; though some would have these cases a different sort of wings, and therefore place them among four winged insects but very improperly; for they seem to be designed by nature to preserve their wings from hard bodies, which they often meet with when they dig holes in the ground, or gnaw rotten wood with their teeth, to make themselves houses or nests. When they fly they fill the air with a humming noise, and perhaps greater than that of any other insect. They have a great aversion to roses, whose smell they cannot bear, and some affirm it will kill them. They are naturally fond of ivy, and delight to get under its leaves. There are different sorts of Beetles, some being large with horns, and others small with none, from which they have different names.

The *Elephant Beetle* is the largest of this kind hitherto known, and is found in *South-America*, particularly *Guiana* and *Surinam*, as well as about the river *Oroonoko*. It is of a black colour, and the whole body is covered with a very hard shell, full as thick and as strong as that of a small crab. Its length from the hinder part to the eyes is almost four inches, and from the same part to the end of the proboscis or trunk four inches and three quarters. The transverse diameter of the body is two inches and a quarter, and the breadth of each elytron or case for the wings is an inch and three tenths. The antennæ horns or feelers are quite horny, for which reason the proboscis or trunk is moveable at its insertion into the head, and seems to supply the place of feelers. The horns are eight tenths of an inch long, and terminate in points. The proboscis is an inch and a quarter long, and turns upwards, making a crooked line terminating in two horns, each of which is near a quarter of an inch long; but they are not perforated at the end like the proboscis of other insects. About four tenths of an inch above the head on that side next the body is a prominence or small horn, which if the rest of the trunk were away, would cause this part to resemble the horn of a Rhinoceros. There is indeed a Beetle so called; but then the horn or trunk has no fork at the end, though the lower horn resembles this. The feet are all forked at the end, but not like lobsters claws.

The *Rhinoceros Beetle*, of this there are several kinds, one of which was brought from the *East-Indies*, and is of a jet-black colour, and has a horn growing on its nose which turns upwards; and about the middle of the belly there is another horn, which arises from a tubercle and turns inwards. The whole body, from the end of the horn to the back part, is four inches long, and the breadth is almost two. It has also

two horns on the head behind the snout, and there are six feet or legs forked at the ends. This has been just taken notice of, and differs chiefly from the Elephant-Beetle, in not having the horn on the snout forked at the end; besides which it has no horn on the belly. There is also another Rhinoceros-Beetle, which is common about Vienna in Germany. The horn has a greater resemblance to that of a Rhinoceros, for it turns up like it, and is sharp at the end, and behind the head it has a prominent bump, and there are six feet as in the former. It is all over as black as pitch, except the belly, which is of a deep red. The horn of the nose is so very sharp, that it seems to be whetted to a point. The third and fourth kinds are much of the same shapes, only the wings of the former are longer than the cases, and in these they are shorter. They look as if they were covered over with shining-ink, and the horns on the head are full of knots. The head is of a greenish gold-colour, and the shoulders are red; but the belly is purple, and the cases of the wings are of the same colour as the head. The feet and legs are of a dun-colour, and the wings under the cases are whitish.

The *Stag-Beetle* is of a dusky-brown colour on the back, or rather blackish, especially about the cases of the wings and breast. It is above an inch long, and about half an inch broad, and it has two horns without joints, but branched like those of a Stag, whence it has its name. When this Beetle is full grown they are as long as a man's little finger, and there are nippers at the end with which this animal can pinch or lay hold of any thing, they being not unlike lobster claws. The eyes are hard, prominent and whitish, and near them on both sides there are feelers, one pair of which are branched, and placed between the horns and the eyes, having each a joint which makes almost a right angle. The other pair are placed in the middle of the forehead and are strait and flat, having each a tubercle like the head of a nail at the end, whence by some they are said to be clavated. It has six feet, of which the foremost pair are longer and greater than the rest. The horns are sometimes as red as coral, which give this Beetle a very beautiful appearance; and the eggs when they are hatched turn into worms with six feet, which are afterwards changed into Beetles. It is very common in Kent and Sussex, and is sometimes seen in other parts of England.

The *Beetle* with lunated, prominent, denated jaws, and a smooth breast, is of the larger kind, being an inch long, and two thirds of an inch broad. The thorax is smooth, convex and black, without any prominences, though it has a sort of an edge. The cases of the wings are smooth and of a blackish purple colour. The jaws are in the shape of a half-moon, and are prominent and black, having two teeth in each. It is found in hedges where there are ash trees, for it feeds on the rotten part of their trunks, and burrows in the earth under their roots.

The *Brafs Beetle*, is of the larger kind, and has a short broad breast, the shape in general being considerably broad in proportion to its length; but the eyes are small, and the legs long and slender. The whole body and outer part of the cases of the wings are of a fine shining green, with a mixture of yellow. It is sometimes met with in our gardens.

The *Beetle* with clavated feelers, and the cases of the wings on the fore part. It is of the small kind, and of an oblong shape, with a black head and breast. The cases of the wings are grey towards the top, but elsewhere

elsewhere the colour is of a dusky blackish brown, with a transverse streak of white. This is common about the carcasses of dead animals, particularly birds. Some would not have this to be properly a Beetle, but call it *Dermestes*.

The *Black Dermestes* with a white spot on each of the cases of the wings, is of the small kind, and has a body of an oval shape, which is black as well as its legs and feelers; on each of the cases of the wings there is a remarkable white spot, with five others so small that they are hardly visible. This animal when touched, or terrified with a noise, will stop and draw its head and legs under the shell of the body. It is common about some houses and old walls, and more particularly in places where victuals are kept.

The *Dermestes*, of a cylindrical shape, with a thick hairy neck, and testaceous cases for the wings. This is also of the small kind, and the body is of the shape of a cylinder, with a thick roundish black hairy neck. The cases of the wings are longish, blunt at the point, and like shells with a black edge or margin running all round them; but the colour of the cases themselves are of a whitish brown, and the body and legs are black. The antennæ or feelers are reddish. The size is not much bigger than a large louse, and when it is touched or terrified it contracts itself and lies quite still. It is very common in houses. The feelers of these three sorts are of a clavated shape, and are perforated transversely. There is another sort of insects of the Beetle kind, with slender feelers like threads, though a little thicker near the ends. This sort, as well as the former, are by some of our best authors placed among the Beetles.

The *Green Tortoise Beetle* with clavated feelers divided into rings, has a very small oval body, convex on the back and flat on the belly. The upper part consists of the cases of the wings and the shield, which are both green and smooth, and appear to be one single crust, divided only by a kind of triangular suture. The belly is black, and the head is entirely hid under the shield. The feelers are pale, only they are of a deeper colour on the top than elsewhere. The legs are of a pale brown, and there is a sort of a prominent rim running round the cases of the wings, which entirely cover the body. It is common in gardens, and may be met with on mint and other herbs. These sort of Beetles are by *Linnæus* called *Cassida*, from the shield.

The *Black Cassida*, or Shield Beetle with feelers like bristles, and a roundish body, is a very small Beetle, of a little longish shape, and of a dusky black colour. The cases of the wings are oblong, and lightly streaked with several very small hollowish spots. The shield is roundish, being somewhat broader than long, and it is rough on the upper part, with a cruciated prominent edge. Sometimes there are two spots on the side towards the hinder part, with yellow hairs thereon. The belly is black, but in some lights has a gloss of silver colour. It is met with in houses in the country, where it often does a great deal of mischief, eating holes in woolen cloths and stuffs. When it is touched ever so lightly it draws up its head and wings under its body.

The over pale-clouded *Cassida*, or Shield Beetle, with an undivided shield that covers the head. It is a very small Beetle, and has a body of an oval shape and of a pale brown colour, spotted and clouded all over with one that is more dusky, which makes it look somewhat like the

the shell of a tortoise. The shield is in the shape of a half-moon, and of a pale colour without spots; but the cases of the wings are streaked and speckled, and the streaks run in crooked lines. The body is black, and the feelers are black and slender. It may be easily found in beds of baum, or mint.

The *Lady-Cow* with reddish cases for their wings, and seven black spots thereon, is an insect well known even to children, and has a black head with two white spots on the forehead, and a black breast, which is whitish near the edges. The cases of the wings are of an orange-colour, and there are three black spots towards the base of each, and one that is common to both, which with the former makes seven in all. The feelers are very small and clavated; and the under part of this insect is black.

The *Lady-Cow* with red cases for the wings, and two black spots thereon, that is one on each. The breast is black, only there is one large white spot on its side, and two very small ones near the base; as also two others of the same size at the insertions of the feelers. The belly and legs are black, as are the feelers likewise; and it is common to be met with on alder and other trees, as the former is among hedges in the Summer time.

The *Lady-Cow* with black cases for the wings, with four red spots thereon, that is two on each case. The breast, is entirely black, and the spots on the cases of the wings are of a blood-red colour; but that which is nearest the breast on each is largest. They are met with on maple trees in the North parts of England, and are sometimes seen, though but seldom, in the hedges near London.

The *Chrysomela* is of the Beetle kind, and the feelers are in the shape of necklaces of beads, but thickest towards the extremities. The body is nearly of an oval shape, and the breast is oblong and roundish. 1. The blew-green *Chrysomela* is one of the largest sort of this kind, though they are all but small. The head is little, the legs slender, and the belly smooth. The back is roundish or convex, and the colour is a mixture of blue and green, with a very fine tincture of gold colour diffused throughout. The edges of the cases of the wings are a little prominent, and they are marked with a few hollowish small spots all the way round. The feelers, legs and belly are entirely green. It is common in the meadows in May and June.

2. The *Chrysomela* with a breast and the cases of the wings of a red colour, is smaller than the former, and not so convex on the back. The head is small and black, as well as the body, legs, lower part of the breast and feelers; but the upper part of the breast is red, as are also the cases of the wings. It is commonly met with on some sort of willow trees in June and July.

3. The blue-green *Chrysomela* with a red breast and thighs, is of the small kind, and the head and cases of the wings are of a beautiful shining green with a blueish cast. There are a few hollow spots on the head, and the breast is small, convex, and of a reddish colour, with a cast of blue-green. The upper part of the legs is reddish and the other black as well as the feelers. It is common in most parts of this kingdom.

4. The black *Chrysomela* with hollowed points, is one of the largest of the kind, and is all over black, and the breast and cases of the wings are

are marked with small hollow points very near each other. The wings are flexible, soft, and blunt, and the feelers consist of twelve joints. They creep but slowly, and are found in quarries.

5. The black smooth *Chrysomela* with the base of the feelers yellowish. It is of a middle size, and the joints of its wings are neither hollow nor streaked, but the black colour of this insect has a blueish cast.

6. The purplish black *Chrysomela* with hollow streaked points, is found upon the birch tree, and feeds upon its leaves. This insect is of a blackish blue inclining to purple, and it is rather of a violet colour, but the belly feet and feelers are black, and the head and breast are marked with very small hollow points without order. The cases of the wings are streaked, and the eyes are hardly to be perceived.

7. The purplish black *Chrysomela* sprinkled with hollow points, is found in the Spring season on the alder tree. It is like the former, only it is larger, and the cases of the wings are marked with hollow points, dispersed here and there, but not streaked.

8. The purplish black *Chrysomela* with the breast yellow on each side, is found upon the willow tree, and is of the size and shape of the former; as also entirely of the same colour, only the breast is red on the sides, round in the middle, and of a violet-colour; but a little blacker on the center. The head and lower belly are black, and there is a black point in the middle of the red that is on the sides of the breast.

9. The green shining *Chrysomela* with a smooth breast, and the cases of the wings marked with hollow points. This is also found upon the willow, and is of a bright green colour. It is marked with hollow points that touch each other, and it is blunt towards the vent. It seems to open the cases of the wings with trouble, and the breast is smooth behind but a little marked with points, and the feelers and feet are black.

10. The green shining *Chrysomela* with the breast hollow before. It has not the breast equally hollowed, but only at the top.

11. The green shining *Chrysomela* with a level breast, is less than the former, but rounder.

12. The *Chrysomela* that is a little testaceous, is found in the beginning of the Spring among rotten wood, and is placed by authors among the largest kind. The colour of the whole body, which is oval, is chestnut, but the eyes are black, and the feelers and the feet red. The under parts of the feet are white, and the cases of the wings are marked with hollow points.

13. The pale green *Chrysomela* is found upon willow trees, and resembles the former, only it is a little smaller; but what distinguishes this from that is the pale colour, and the nine rows of points on each cases of the wings, placed long ways. The eyes are black and the bottom of the feet white.

14. The Red *Chrysomela* with a cylindraceous breast, is found upon the flower de luce. It is of a middle size, and its breast, cases of the wings, and the top of the head are red; but the feelers, eyes, knees, belly, breast plate, and under part of the head are black. The breast is much narrower than the cases of the wings, and is hollow on each side. The cases of the wings are marked with hollow points of a middle size.

15. The Copper coloured *Chrysomela* is very common on willows, and is of a middle size. It is of the colour of red copper that has been polished.

19. The blackish blue *Chrysomela* with red cases of the wings, is found on the poplar tree, in the begining of spring, whose leaves it feeds upon. It is one of the largest sort, and its red wings are marked with small points, and the extremity of each case of the wings has a black spot, and the breast is smooth and of a green and black colour, as well as the corset, belly, and feet; but the feelers are black. The cases of the wings of this kind are not plates or leaves, but seem to be made up of eleven joints, of which the last is largest. It throws out an oily fluid when touched, and stinks so abominably, that few are able to bear it.

17. The *Chrysomela* with a red cylindraceous breast, and red cases for the wings, is found on the branches of asparagus, and devours the stalks. It is but small, and has a head of a blackish blue, with black feelers, and the breast narrow and cylindric, marked behind with two black points. The cases of the wings are oblong, yellow, and of a fallow colour on the external edge; there is also a blue spot like a cross on the cases of the wings.

18. The *Chrysomela* with a green breast, and red cases of the wings, marked with a blue cross. For shape it is much like that of the poplar tree, and the colour of the head and breast is that of green copper, with black feelers, and the feet are generally black. The head, breast, and cases of the wings, are of a singular beauty, and painted with copper-coloured streaks, a little inclining to blue.

19. The oblong black *Chrysomela* with red cases of the wings marked with four black spots, is very largest of this kind, and is of a rounder shape. There are two large spots on each case of the wings, the first of which is oval, but the other more short. The feelers are almost dentated, and the breast is short.

20. The red *Chrysomela* with each cases of the wings marked with five black spots. It is found upon willow trees, and is one of the largest of this kind, having a black head with a red breast, black in the middle, and red cases of the wings, upon each of which there are five large black spots of an unequal size. The belly and the under part of the feet are black.

21. The long dusky *Chrysomela* with the letter S marked on the cases of the wings. The breast is grey with white hair, and the cases of the wings are of a greyish-brown, with a white spot of the size of a grain of caraway-seed, of the shape as above.

22. The *Chrysomela* with dusky wings that are livid on the back part, is no larger than a flea, and the body is black, and the breast brown.

23. The livid *Chrysomela* with black eyes, is small, and of a pale livid colour.

24. The *Chrysomela* that is reddish on the upper part, with two black spots on the breast, and several on the cases of the wings. It is found on the poplar tree, and is of a middle size, with a black head.

25. The *Chrysomela* that is of a blackish brassy colour, with the edges of the cases of the wings yellow. It is of a middle size, and has the external edge of the cases of the wings and the breast yellow; but the middle

middle of the breast and head are of a blackish copper-colour. The lower part is quite black, as well as the feet, and the body is oblong.

26. The blackish brass-coloured *Chrysomela* with two yellow lines on the cases of the wings, has an oblong body. There is on the latteral edge of the breast in the middle of each case of the wing, and on the external edge, a long line of yellow colour; the legs and the internal part of the thighs are also of a yellow colour, and the feelers are knotted.

27. The *Chrysomela* with a black breast, and red cases of the wings marked with a black spot. It is of a middle size, and has a narrow oblong body, with the feelers, head, breast and belly black; but the wings are white, and the feelers smaller than in other kinds; the cases of the wings are of a bright red, furnished with eight streaks or upwards, consisting of hollow points; and the base on the points are black.

28. The blueish-green *Chrysomela* with a red breast and thighs, makes its nest in the galls of the willow tree. The head and cases of the wings are shining, and of a blueish green, marked with hollow points. The breast is small, marked with a reddish green or reddish chestnut colour, and it is thick and convex. The feelers and the bottom of the feet are black.

29. The *Chrysomela* of a yellowish shell colour, with short wings, is met with among flowers, and is of the size of a louse, with an oblong smooth body. The feelers are full of knots; but the cases of the wings are furrowed, and shorter than the two joints of the belly.

30. The testaceous oblong *Chrysomela* with accumulated cases of the wings, is found on trees, and is the least insect of this kind. It is of a chestnut colour, with the feelers like threads, and pointed cases of the wings which cover the tail.

31. The dusky *Chrysomela* with a blackish head, is found on the windows in the spring, and is somewhat less than a flea. The body is oblong, and the feet are of a paler colour than the body, which is of a black chestnut colour; with a black head.

32. The *Chrysomela* with dusky cases of the wings, and a yellow edge, is of a middle size, with a brown head. The breast is yellowish, and the cases of the wings almost black; but the feet are yellow, and the feelers alternately black and yellow. The wings are brown with black veins, and the belly yellow marked with a broad black line.

The *Curculio* or *Weevil*, is a small insect not unlike a bug, which is found among corn, wherewith it is nourished, and it eats all the inside, but leaves the bran behind. But there are different kinds of these, which feed in a different manner, of which the following are mentioned by *Linnaeus*.

1. The brown oblong *Weevil* with strait and sharp cases of the wings, is the largest of those that are found in *Sweden*. The cases of the wings are not so large as in other insects of the same kind; but the feelers are big, and have the last joint of a red colour, and very long.

2. The dusky *Weevil* with streaked cases of the wings, and as hard as shells. *Linnaeus* comprehends under this species the Dusky Weevil with shelly cases of the wings, and marked with two streaks. The greater Beetle, with rough cases of the wings, of a greenish ash-colour, and variegated with black. The black *Norway Weevil*, variegated with yellowish signatures. He says there are several sorts of the second kind in the fields of *Sweden*. It creeps slowly, and sticks fast to any

thing it touches. When it is taken it endeavours to pinch the skin, and is found upon thistles. It is of a blackish grey, and has the body, mouth, breast, cases of the wings and legs, marked with specks near each other, which are all hollow. This insect gets among the leaves, where it changes, and becomes a winged Weevil.

3. The *Grey Weevil* with an iron-grey mark on the cases of the wings, and is found upon willows, being like the former. It is grey and white, with black feelers, and jaws almost as long as the breast. The end of the breast is white, and there is a spot of a tawny colour, on the middle of each case of the wings.

4. The *Weevil* variegated with black and white, and with a plain carinated trunk of the length of the breast. *Frisch* calls it the Weevil with a short snout. This insect is of the shape of the former, and the colour is black and white.

5. The *Weevil* of a dusky brass colour, with a short snout and breast. It is called in the Transactions of *Uppsala*, the accumulated Weevil, of a longish shape and of a dusky brass colour. This insect is very common in *Sweden*, the female is larger by half than the male.

6. The *Weevil* with a short snout and breast, and marked on the breast with three pale streaks. It is common in the gardens and meadows, and is twice as large as a louse. The body is grey, but the feelers are reddish.

7. The *Black Weevil* with a trunk or snout the length of the breast. It is of a middle size.

8. The *Ash-coloured Weevil* is of a longish shape, with blunt cases of the wings. *Lister* calls it the brown Beetle covered with hoary hair. It is found among grafts, and is less than the former, and is oblong, black, and covered over with fine down.

9. The *Ash-coloured oblong Weevil* with red feet, is like the former in shape, size, and colour, and might be taken for the same, if the thighs, legs and feet, were not of a yellowish red colour; besides it has no down. *Linnaeus* takes it to be the female of the former.

10. The *Grey Weevil* clouded with black, is of a longish shape, and the feet and feelers of a dusky colour. This is to be met with among forrel, where it makes its nest, and afterwards is metamorphosed into a winged Weevil. It eats the leaves of forrel on the under side.

11. The green opaque *Weevil* with dusk feet and feelers. This is of a middle size.

12. The blueish-green shining *Weevil* with black feelers, is the small *Weevil* of *Petiver*, of a shining green colour. This insect is met with on the leaves of the birch tree, and is of the middle size. The whole head, breast, jaws, cases of the wings, belly, and feet of a golden blue-green.

13. The purple shining *Weevil*, is met with in the woods, and is smaller than the former, with a very long head.

14. The *Weevil* marked with a tooth on the fore thighs, and a body clouded with grey. It is found in the blossoms of trees, and is larger than a louse; the colour is brown inclining to grey. It has two streaks that run along the cases of the wings, and the feelers and feet are of a brown colour.

15. The *Weevil* with all the thighs marked with a tooth, and of an oblong greenish body, is found upon nettle-leaves, and is of a middle size.

size. The body is longish, the head of the length of the breast, and the cases of the wings almost pointed, which has been seen on the seed of figwort, before it was ripe.

16. The roundish *Weevel*, with two black points on the longitudinal suture of the cases of the wings, and a whitish breast. In the transactions of *Upsal* is called the Globous *Weevel*, with a trunk turned back; and *Lifter* calls it the small ash-coloured Beetle, marked with two black spots on the cases of the wings.

17. The roundish *Weevel*, clouded with brown, and a white spot in the shape of a heart on the middle of the back. In the transactions of *Upsal* it is called the least ash-coloured roundish blunt *Weevel*; and it is found on the same plant as the former, and is of the size of a mustard-seed.

18. The oblong *Weevel* with a reddish shell, and the breast almost as long as the cases of the wings. *Mr Ray* calls it the small dirty-brown Beetle, with a long trunk bending downwards. It is found upon several sorts of seeds, on which it lives, and is of the size of a louse.

19. The pitchy *Beetle* with an oval belly, is very common in *Sweden*, which is all that *Linnaeus* says of it.

20. The Corn *Weevel* is shaped like a bug, and feeds upon corn. This is the first that was spoken of.

21. The black *Weevel* with longish opaque cases of the wings, is twice the size of a flea, and is of a black colour. The cases of the wings are streaked, and marked with opaque points.

22. The black *Weevel* with shining cases of the wings, is less by one half than a flea, of a black colour, and the cases of the wings streaked, shining, and marked with points. It is four times less than the former, and the cases of the wings and belly are of an oval shape.

23. The black *Weevel* with the cases of the wings of a blackish blue, is found in hedges, and is of the size of a flea. The head, breast, and feet are black, marked with small hollow points, and the cases of the wings are of a violet-colour, or of a blackish-blue.

24. The blackish-blue *Weevel* is found in hedges like the former, and is of the size of a flea. The head, breast and thighs, are of a blackish-blue; but the cases of the wings are of a deep blue.

25. The black *Weevel* with whitish thighs, is very like the former in shape and size; but the cases of the wings are black and streaked; and generally the legs are pale, with black feelers. The head and breast are marked with hollow points.

26. The ash-coloured *Weevel* with a black spot on the cases of the wings, and legs of a paleish yellow, is found on the leaves of willow. It is no bigger than a louse, and the head and jaws are black without hair; the breast is also black, and covered with ash-coloured hair. The cases of the wings are black, streaked and covered with the like hair, and in the middle of each wing there is a black spot. The feelers are of the same colour as the legs.

27. The ash-coloured *Weevel* with red legs, is common in dry grounds, and is of the size of a flea. The colour is ash, and the cases of the wings streaked, with reddish feet.

28. The Ash-coloured *Weevel* with longitudinal streaks of a lighter colour, is found among the sand. It is larger than a louse, and is of an ash-colour all over. The eyes are black, the feelers ash-coloured,

and there are several lines ; one upon the back, of a bright ash-colour, and another upon the wings of a light ash-colour.

29. The livid *Weevel* with the cases of the wings spotted with four dark spots. It is found upon the leaves of the alder-tree, and is a leaping insect of the size of a louse.

30. The blood-coloured *Weevel* is found in corn, and is much of the size of a louse.

31. The black *Weevel* with the cases of the wings red in the middle, is found among flowers, and is of the size of a flea.

32. The black *Weevel* with red cases of the wings, and a longish hinder part of the head ; differs very much from the former kinds ; for the head is black, and looks like that of a fox deprived of hair. The jaws are short, the feelers black, and the wings of a deep red, but streaked and marked with hollow points.

33. The black *Weevel* with black cases of the wings, and a double white streak at the base, which is red, is very common every where. It has a black head sunk into the breast, which is red without hair, and the body is short and without a trunk.

The *Flying-Beetle* of the West-Indies, called by the natives *Acudia*, is a shining insect, and is almost as big as a Wren. There are four shining spots like stars, two of which are near the eyes, and two under the wings. Some pretend, the natives, before the coming of the Spaniards, made use of these Beetles instead of candles.

There is an insect of the Beetle kind, known in *England* by the name of a *May Bug*, and in some places a *Dorr*. It has two pair of wings, one of which may properly be called the cases, and the other the real wings. The cases are hard, and of a reddish brown, sprinkled with a whitish dust, which easily comes off. The legs and tail are whitish, but the rest of the body is brown, except a white and dentated line wherewith each joint is marked on both sides the belly. It is thought that the females make holes in the earth with their tails for the sake of propagation ; but it is uncertain whether they lay eggs or small worms. But be that as it will, these worms are prejudicial to the roots of corn and young plants ; and they are sometimes so numerous, as to do prodigious mischief ; they continue to long in this state, that they are the more dangerous on that account ; and it is said the hardest frost will not hurt them. Rooks and hogs are very fond of these worms, and devour vast numbers of them ; hence the advantage of rookeries is very evident, as the inhabitants of the county of *Norfolk* have found to their cost ; for they lately took it in their heads to destroy them all, since which time they have been pestered with great numbers of these worms, which have destroyed the roots of the wheat to their very great damage. One farm in particular was so injured by them in the year 1750 and 1751, that the occupier was not able to pay his rent, which the landlord was not only content to lose, but likewise gave him money for the support of his family.

These *May-bugs* are seen most frequently flying about in the evening ; for in the day time they hide themselves in the leaves of several trees till sun-set, when they appear in great numbers, and often fly in the faces of passengers.

Mouset informs us, that in 1574 there fell such a great number of these insects into the *Severn*, that they stopt the wheels of the water-mills.

mill. This was on the 27th of *February*; but the larger sort do not appear till *May*. In *Ireland* they suffered so much by these insects, that they resolved to set fire to a wood of some miles extent, to prevent their communication with others at some distance. And indeed it is certain, that where there are few trees and many rooks, the inhabitants are least infested with them.

In some years their necks are covered with a red plate, and in others with one that is black; but these are distinct sorts; and some have observed that they do not appear in the same year, but alternately. *Refel* has been so curious as to catch some of these insects and put them under glasses, where they laid great numbers of eggs; from whence it is plain that they do not bring forth their young alive, which was doubted of before. They soon change to worms of a white colour, and at last increase to a considerable bulk, and he kept them two years in this state, and some three, without any change, excepting their becoming larger. At this time they were an inch and a half long, and of a yellowish white colour. Their body consists of twelve segments or joints, as those of caterpillars, without including the head. On each side the body there is a protuberance that runs all along the segments; in it there are nine holes, through which this worm is supposed to breathe. Under the three first there are six feet, of a reddish-brown, composed of four or five joints, and they are all alike hairy, and of the colour of the feet. The head is large in proportion to the body, and of a brownish shining yellow, with a pincher or nipper placed before, of a deep brown, and blunt, but dentated at the end; between these there is a sort of semicircular lip, and by the help thereof, this insect cuts the roots of plants and sucks out their moisture. There is no appearance of eyes, but behind the nipper there is a feeler, consisting of five joints, and of a brownish-yellow colour. This worm changes its skin once every year, and towards the end of the fourth year becomes a *May Bug*.

The American ball *Beetle*, called by the inhabitants *Tumble-dung*, is the most numerous and remarkable of the *Beetle-kind* of any in *North-America*. Their employment is to find nests for their eggs. They are endowed with sagacity to discover subsistence by their excellent smelling, which directs them in flights to excrements just fallen from man or beast, on which they instantly drop, and fall unanimously to work in forming round balls or pellets thereof, in the middle of which they lay an egg. These pellets in *September*, they convey three feet deep in the earth where they lie till the approach of spring, when the eggs are hatched and burst their nests, and the insects find their way out of the earth. They assist each other with indefatigable industry in rolling these globular balls or pellets to the place where they are to be buried. This they are to perform with the breech foremost, by raising up their hinder part, and shoving along the ball with their hind feet. This insect is all over of a dusky black, and has six legs, two of which are joined to the breast and four to the belly. They are always accompanied with other Beetles of a larger size, and of a more elegant structure and colour. The breast of this is covered with a shield of a crimson colour, and shining like metal; the head is of the like colour, mixed with green, and on the crown of the head stands a thinning black horn bended backwards. These are called the kings of these beetles, but

but for what reason is uncertain, since they partake of the same dirty drudgery with the rest. It is a very strong insect, for if one of them be put under a brass candlestick it will cause it to move backwards and forwards as it were by an invisible hand, to the no small admiration of those who are not accustomed to the sight.

There is another insect which at first appears to be of the Beetle kind, to be met with in *South-America*, and particularly in *Surinam*. It is of a very heavy sluggish nature, and is furnished with a long tube or trunk under its nose, which it thrusts into flowers to suck out the honey. When it is preparing itself for transformation, it lies motionless for a considerable time, till at length the skin breaking on the back, there comes out a flying insect, with four wings that are transparent, and of a pale rose colour, veined with scarlet, and bordered all round with a pale yellow. The trunk of the body is much the same as in the Beetle state, though it entirely throws off its skin or shell, which was of a deep green colour. When it is transformed to a fly, it is exceeding swift, and makes a noise with its wings like a harp.

There have been the solid shells of a sort of Beetle brought to *England*, that were found on the eastern coast of *Africa*, over against part of the island of *Madagascar*, which the natives hang to their necks, and make use of them as whistles to call their cattle together. Their upper surface has the appearance of rough wings, which are so strongly united to those below after they are dead, that one would imagine they never could be made use of while they were alive. On its upper side it has above a dozen rows of round knobs, running lengthways, and between them there are others that are very small. The colour is black, spotted with red between each knot in the rows of the back, and it has also red spots on its under side. These Beetles when living, will fly with great force against a person's head or face, though when they are dead they seem incapable of any such motion as flying.

Linnaeus divides the Beetles into two kinds, the great and the little; of the former, there are,

1. The black *Beetle*, with spotted and streaked cases of the wings; the head is small, the eyes prominent, the feelers consist of eleven joints, and are as long as half the body. All these sorts of Beetles have an oblong body, feelers like bristles, a breast made in the shape of a heart, an elevated mouth, a strong smell, and they run and fly very swiftly. This has the smell of tobacco, and is found among rotten wood.

2. The black *Beetle* with greenish cases of the wings, that are convexly spotted and streaked. It is like the former, and has the same smell.

3. The black *Beetle* with the cases of the wings like copper, and convexly spotted and streaked. It is like the former, only the cases of the wings, the breast, and the hinder part of the head, are of the colour of copper. It is found among rotten wood.

4. The purplish-black *Beetle* with the cases of the wings concavely spotted and streaked. It is the purple spotted *Cerambix* of *Ray*; and the black *Beetle* with furrowed cases of the wings and hollow spots. It is like the former, and is found among putrified vegetables.

5. The black *Beetle* with eight streaks on each wing, is like the former, and is found in the same places. It is called by *Lister* the entirely black *Beetle*, with crustaceous cases of the wings,

6. The blackish violet *Beetle* with the cases of the wings a little wrinkled, is called by *Frysch* the small black *Beetle*. It is like the former, only the edges of the breast, and the cases of the wings, are of a bluish purple.

7. The green *Beetle* with furrowed cases of the wings, but without points, and the feet and feelers of a brown colour. It resembles the former, only it is green, with a blueish cast.

8. The black *Beetle* with green furrowed cases of the wings, and black feet and feelers. It is the *Cerambix* of *Ray*, with a back divided into long lines, and the most beautiful of all this kind. It is like the former, only the head, breast, and cases of the wings above, are of a shining green, marked with three or four streaks of different green, between which there are furrows. The edge of the cases of the wings is of the colour of fire; but the body, feet, and feelers are black.

Those of the least sort, according to *Linneus*, are,

1. The shining *Beetle*, with head and breast of a bluish green, and with purple wings. It shines like gold, and the cases of the wings have streaks that are hardly visible.

2. The *Beetle* which is of a copper colour above, with hollow pointed cases of the wings, and red feet. The colour of the back is variegated with green, red, copper colour and brown; the cases of the wings are marked with three points; the thighs are black, the legs red, and the feelers at the third joint are furnished with three silky threads. It is of the size of a house fly, but narrower, and is found in meadows.

3. The black *Beetle* with red feet, is in shape and size like the former, only it is quite black, and the cases of the wings are streaked.

4. The blackish *Beetle* with pale legs, is only half as big as a house fly, and the head, breast, and cases of the wings are of a blackish copper-colour, and the cases of the wings are marked with eight streaks. The feet are black, except the middle of the legs.

5. The pale testaceous *Beetle* with smooth wings, is of a middle size, with very small feelers.

6. The black *Beetle* with a brown breast, as well as the feelers and feet. It has a black head, and the cases of the wings of the same colour, and streaked.

7. The *Beetle* with the head and cases of the wings blue, and the breast red, or of a saffron colour. The feelers are mostly black, and the feet are variegated with red and black. It is of the size of a small fly.

8. The *Beetle* with a black head and cases of the wings, but a red breast; it is of the same size and shape as the former, and the feet and feelers are brown.

9. The blackish copper-coloured *Beetle* with black feelers and feet, is of the size and shape of the former. The breast is more black than the other parts, and shining, marked with two hollow spots; but the cases of the wings are streaked and silky at the extremities, and the under part of the body is black.

10. The black *Beetle* with a brown streak on the hinder part of the cases of the wings, and a spot on the sides of the same colour, but the feelers are black and red, the feet pale, and the wings brown.

11. The black *Beetle* with grey cases of the wings, is about twice the size of a louse.

12. The black *Beetle* with black feet and feelers. The breast is thinning and narrow at the lower part, but the wings are streaked, and on the middle of each there is an hollow point.

13. The pale testaceous *Beetle* with black eyes, is of the size of a large louse, and of an opaque colour. The cases of the wings are streaked.

14. The black *Beetle* with a brown breast, and the cases of the wings marked with four livid spots; the feet are also brown, and there is a brown spot on the joints of the wings.

15. The grey *Beetle* with the head, belly, and base of the cases of the wings blackish. It is scarce so big as a louse, and the feelers and feet are grey.

Linnæus has seventeen sorts of *Dermestes*; namely,

1. The black *Dermestes* with the fore parts of the cases of the wings of an ash-colour; it is called by *Ray* the beetle with clavated feelers; and by *Frysch* the small Bacon Beetle, with a transverse streak of a whitish colour, on the dusky blackish cases of the wings. It is fond of bacon, and all sorts of dead bodies.

2. The black *Dermestes* with a double undulated white streak on the cases of the wings; in which last particular it differs from the former, but in other respects is like it.

3. The black *Dermestes* with two white spots on the cases of the wings. It is named by *Frysch* the black *Dermestes*, with a white spot on the cases of the wings. It is of an oval shape, and when the cases of the wings are closed, two white spots appear on the back; besides which there are five others; that is, one on the point of the corset, one on each side the breast, and one along each case, towards each case; but they are all very small, and the feelers are in the shape of a club. It is found among cloaths, on walls, and about provisions.

4. The black *Dermestes* with two red specks on the cases of the wings. It is called in the transactions of *Upsal* the Black *Dermestes*, with the cases of the wings marked with a red spot. This insect, as well as the two former, is fond of Bacon.

5. The black *Dermestes* with four red spots on the cases of the wings. It is said by *Frysch* to be a small beetle, spotted with yellow, that proceeds from a hairy worm, found among wool. It may be seen on trees, and sometimes on windows.

6. The smooth black *Dermestes*, of a clouded ash-colour, with a yellow corset. *Frysch* calls it the Beetle proceeding from a smooth black caterpillar.

7. The testaceous hairy *Dermestes* with streaked blunt cases of the wings; it is called by *Ray* the Beetle with ten elevated feelers, and in the *Upsal* transactions the hairy *Dermestes*, with the points of the cases of the wings seeming to be gnawed off. It is of a bright brown, with streaked, furrowed, and dentated cases of the wings. It is to be found under the bark of the pine tree, where it makes crooked furrows.

8. The smooth testaceous *Dermestes* with the hinder part of the cases of the wings hairy and blunt. It is fond of carrion, and also feeds on other insects.

9. The black *Dermestes* with grey cases of the wings that are black on the edges. It is called in the *Upsal* transactions, the Cylindrick *Dermestes*, with a thick hairy collar, and testaceous cases of the wings. It is small, and when touched, rolls itself up.

10. The black *Dermestes* with grey cases of the wings, is no bigger than a flea.

11. The black oblong *Dermestes* with a sharp belly, is called in the *Upsal* transactions, the least flower-eating Beetle; and by *Ray* the Beetle, with clavated feelers, which are divided into rings. It is of the size of a louse, with an oblong body, and a flat belly, pointed at the end.

12. The black *Dermestes* with blackish cases of the wings. It is found among putrified cabbages, and in the winter in cellars and green-houses.

13. The black *Dermestes* with red feet, and the cases of the wings marked with nine streaks, is a water insect, twice as big as a louse.

14. The blackish-blue *Beetle*, is of the size of a grain of rice, blue above, and blackish below, with a hairy corset.

15. The blackish-brown *Dermestes* with shining speckled cases of the wings; it is of a cylindric shape, and of the size of a large louse.

16. The oblong smooth testaceous *Dermestes* with black eyes, may be seen among horse-dung in the beginning of the spring.

17. The brown *Dermestes* with a breast somewhat testaceous, and the croset of a bright brown, is about the size of a louse.

The *Goat-chaffer*, or *Capricorn-beetle*, is of the same size as the Stag-beetle, as also of the same colour: the head is broadish, and the eyes large, with a forked gaping mouth, and two exceeding hard crooked teeth, with which it is enabled to gnaw wood, at which times it makes a noise like the grunting of a pig: the shoulders are of a very curious structure, seeming to be carved, and having a haft of the colour and polish of ebony. It has six legs, three of which are furnished with knees, that are weak, and scarcely able to support the body. It has two horns growing above the eyes, and longer than the body, consisting of ten flexible joints, not exactly round, but rough like those of a goat. It can turn them any way it pleases, only when it flies they are thrust directly forwards; and when it is weary with flying, they are used instead of feet. When it rests upon trees, it embraces a branch with its horns or feelers, and hangs thereto; insomuch that it looks not much unlike the bird of Paradise.

The larger Capricorn green *Beetle* with the scent of musk, is a very large beautiful insect, all over a glossy lovely blue green colour, with a cast of a shining golden yellow: the body is blue on the upper part, and the wings under the case are black: the legs are of the same blueish green colour, only somewhat paler, and the breast is pointed at each extremity. Between these points there are three little tubercles near the wings, and three smaller towards the head: the cases of the wings are oblong, and somewhat in the shape of a lance, with three ribs a little raised and running longways: the feelers are nearly as long as the body, and are composed of many small joints, which grow smaller near the ends. It is sometimes found among old willow trees, and has a sort of a musky smell.

The Russian Capricorn *Beetle* with very long horns, is about three quarters of an inch long, and is all over of a grey colour: the cases of the wings are blunt and furnished with many small hairs; and among them there are several small tubercles. A dusky blackish shade runs across the wings, which at the hinder part bends towards the middle: the breast is pointed at each end, and has four beautiful yellow spots

towards its hinder part : the eyes are black, and there is a black spot near the feelers, which are five times as long as the body : they are grey, and consist of ten joints, which are shorter the nearer they are to the head ; but the wings are black streaked with brown. The female has an elongation at the vent, which renders the body one third of the length of the feelers. It is found among old wood, but is not very common with us.

The black Capricorn Beetle with a hairy grey breast, has an oblong and somewhat depressed body, of a deep black colour, with a little mixture of grey. It is covered with many short hairs with prominent tubercles between them ; but all the breast is hairy and black, though the hairs are white, which give it a greyish appearance ; only on its hinder part there are two smooth prominent spots : the feelers are slender and black, and about half the length of the body, and there is an undulated line on the case of the wings, but so faint, that it is scarcely visible. It is found among timber, but it is not very common with us.

Linnaeus has eighteen sorts of these Beetles, the first of which is the green and blue Capricorn Beetle, with feelers nearly of the length of the body : this has a fine agreeable smell, and is found upon willow trees. It is the largest sort that is seen in *Sweden*, and is the same with one already mentioned.

2. The cloudy Capricorn Beetle with feelers longer than the body, and the breast marked with four yellow spots : this is the same as the *Russian* Beetle, and is found on the trunks of trees that are stript of their bark with which the peasants make their huts.

3. The black Capricorn Beetle with a flattish breast, that has three teeth on the margin on each side, and the cases of the wings as black as pitch : this is the same as the great *Cerambix* of *Ray*, with large articulated horns bending back : it has a very large flattish body, longer than the feelers, and of the shape of a common Beetle : this is a kind of stag Beetle.

4. The red Capricorn Beetle with the cases of the wings marked with three longitudinal black spots : this is the largest kind of Beetle that is found in Europe, and has the belly, feet, mouth and forehead, of a dark red ; the belly is covered with hair.

5. The black *Stag-beetle* with speckled cases of the wings, and pale spots sprinkled thereon, with feelers longer than the body, and a prickly breast : it is found in forests, and is of the largest kind.

6. The small Capricorn Beetle of an ash-colour, with black cases of the wings, and feelers half as long again as the body : the head is black, and it is found in *Gorbländ*.

7. The ash-coloured Capricorn Beetle with cases of the wings, part of which seem to be bitten off, marked with black points, with a white streak ; as also with feelers half as long again as the body : this is of the length of a common fly, but more slender ; and it is often seen in houses in the country.

8. The Capricorn Beetle, of a cloudy black colour, with feelers shorter by half than the body, and a prickly breast.

9. The ash-coloured Capricorn Beetle with the cases of the wings marked with two yellow streaks, and feelers by one half shorter than the body, with a prickly breast. It is like the former, only the cases

of the wings are of a browner colour, and marked with two yellow streaks.

10. The testaceous Capricorn Beetle, with the cases of the wings marked with two whitish streaks, and a prickly breast. It is no bigger than a louse.

11. The black Capricorn Beetle, with the cases of the wings marked with two white undulated streaks, and a smooth breast: the feelers are long, and it is of the same size as the former.

12. The blackish Capricorn Beetle, with a hairy ash-coloured breast, marked with two smooth points. It is by some called the Tree-Beetle, with small feelers, and an ash-coloured collar, marked with two points. It is found among piles of wood.

13. The testaceous Capricorn Beetle with a hairy ash-coloured breast, marked with two smooth lines: this insect is of the same shape as the former, but shorter, and the feelers are not so long as the body.

14. The testaceous Capricorn Beetle with a smooth breast, does not differ much from the former, only the feelers are longer than the body, and the thighs and feet are yellow inclining to red.

15. The brown Capricorn Beetle, with points impressed on the breast, and feelers shorter than the body.

16. The grey Capricorn Beetle spotted with black: this is called by Petiver the Norway Capricorn Beetle, of a blackish colour, with spotted cases of the wings, and speckled with pale spots.

17. The black Capricorn Beetle, with the cases of the wings marked with a longitudinal yellow spot, which is dentated, and there are also yellow spots: this is of a longish shape, and has the breast adorned with yellow hair.

18. The violet-coloured shining Capricorn Beetle, with black feelers and clavated thighs. It is found in gardens and in woods, and is all over of a fine violet mixed with gold colour: the feelers are a little longer than the body.

There are several sorts of *Unicorn Beetles*, which may be placed under two divisions, the first of which has sharp protuberances on the breast, and the second none. Of the first division, beside the two already described, are the black *Unicorn Beetle*, with a flattened breast, and the edge of it having three feet on each side, and the feelers are coal black: the reddish *Unicorn Beetle* with three black lines on the cases of the wings, running lengthways: the black *Unicorn Beetle*, with irregular pale spots on the cases of the wings, and a prickly breast; and has also feelers longer than the body: the grey *Unicorn Beetle* spotted with black, and a black transverse line on the cases of the wings, and the feelers longer than the body by one half: the grey *Unicorn Beetle*, with black cases of wings spotted with white, and a white transverse line on each, with feelers longer than the body by one half: the grey and black *Unicorn Beetle*, with the feelers about half the length of the body: the grey Capricorn Beetle, with two yellow transverse lines on the cases of the wings, and the feelers half as long as the body: the shelly Capricorn Beetle, with a double white transverse line on each wing.

Of the second division, which have no protuberances on the breast, there are the black Capricorn Beetle, with two white undulated transverse lines on the cases of the wings: the shelly Capricorn Beetle

with a grey hairy breast, and two smooth short lines thereon: the shelly Capricorn Beetle, with a smooth breast: the brown Capricorn Beetle, with spots impressed on the breast: the grey Capricorn Beetle, with the cases of the wings spotted with black: the black Capricorn Beetle, with a longitudinal dentated yellow line and yellow spots on the cases of the wings: the shining violet-coloured Capricorn Beetle, with black feelers and clavated thighs.

Linnaeus has only four sorts in his *Systema Naturæ*, which are mentioned among those above.

The *Leptura* is a sort of a Beetle with feelers like bristles, and the cases of the wings truncated at the points; as also a round breast: the Tree-Beetle, or greater violet-red *Leptura*, is of the large kind, with an oblong-shaped body, smallest behind; the legs, feelers, and all the other parts, except the cases of the wings, are black, though in some lights it has a whitish cast: the cases of the wings of the female are of a deep red; but those of the males are not so deep, and are black or grey on the edges. All the surface of the cases of the wings in both is adorned with a multitude of small hollow dots, with a few short fine hairs: the head and breast are sometimes yellowish. It may be often met with in the woods, and *Ray* calls it a Unicorn Beetle, with the head, shoulders and feelers black; but of a blackish yellow at the extremities.

The middle-sized *Beetle*, with a black oblong narrow belly, and variegated with yellow lines and spots. It is of an oblong narrow shape, the general colour is of a blackish brown; only the upper edge of the breast is yellow, and there is a yellow spot where the cases of the wings join. Likewise there are some undulated yellow lines running transversely thereon; and they are truncated at the point, and are a little hairy, and the feelers and legs are of a reddish brown. It is not uncommon among the hedges in orchards and gardens.

The yellow gold-coloured *Leptura*, with black feelers, and dentated hinder legs: the body is oblong, and the head small: the colour resembles that of copper, with a mixture of fine strong gilded yellow variegations: the head, breast, and cases of the wings, as well as the legs, are all speckled with extremely minute, and almost contiguous hollow dots, which are irregularly dispersed over the breast, head, and legs; but on the wings they are pretty regular, and placed in ten rows, running lengthways, forming so many lines: the eyes are black, and the feelers brown.

Linnaeus has fifteen insects of this kind, of which the first is, The greenish-yellow *Leptura*, with yellow feelers, variegated with green. It is the largest of the kind, and in the *Upsal* transactions is named the greatest black *Leptura*, greenish underneath.

2. The black *Leptura*, with the breast and cases of the wings red; it is pretty large, and the legs are yellow.

3. The black *Leptura* with blackish cases of the wings, variegated with a livid colour. It is found in *Sweden* as well as the former.

4. The black *Leptura* with reddish and greenish cases of the wings, is called by *Ray* the *Cerambix*, with the head and shoulders and feelers black, the cases of the wings yellow and black at the extremity, and in the *Upsal* transactions, the *Leptura* with testaceous cases of the wings; but this is the male, and the female is termed the *Leptura* with red cases.

cases of the wings. It is a sort of a *May Bug*, and of a violet-red colour; it is commonly seen on bushes.

5. The black *Leptura* with the throat, cases of the wings, and legs purple; it is like the former, but twice as big.

6. The black *Leptura*, with the cases of the wings and breast yellowish. It is much of the same shape as the former, but less.

7. The *Leptura* with livid cases of the wings, marked with four black spots. It is of the greatest sort, and is found in forests.

8. The *Leptura* entirely black, is a little bigger than the former, but the wings are not so large.

9. The black *Leptura* with testaceous cases of the wings, which are marked with six black spots. It is called in the *Upsal* transactions the *Leptura*, with testaceous cases of the wings and black spots; it is all over black.

10. The black *Leptura* with the cases of the wings marked with four brown spots, has a black body and wings, and is one of the largest of the kind.

11. The black *Leptura* with yellow cases of the wings, is not so big as a louse, and the feelers are almost as long as the body, the wings are yellow and black at the points.

12. The black *Leptura* with cases of the wings marked with transverse yellow lines, and testaceous feet. It is called by *Lijster* the Black Beetle, marked with yellow lines and feet nearly of a saffron colour. It is found in meadows and the branches of trees, and in gardens.

13. The black *Leptura* with testaceous wings, marked with two points, with a crois and black streaks.

14. The gilded *Leptura* with black feelers, and the hinder thighs dentated. It is called by *Frysch* the Tree-beetle, of a purplish golden colour, and it is found in moist places.

15. The *Leptura* of a violet copper-colour, with the hinder thighs dentated. It is found upon the banks of rivers, and in places where there is much sand and gravel.

The violet black *Dung beetle*, called by *Ray*, the Greater Beetle, with an oblong body, of a purplish black colour. It has a small head, and large prominent eyes, with pretty long, and very slender feelers: the general colour is black, only the edges of the breast and wings are of a deep beautiful glossy purple: the cases of the wings have neither dots nor lines, but they have a sort of wrinkles, which run longways, and others that crois them, which are not very visible. It is common on dung-hills, and among rotten vegetables.

The purplish black *Dunghill-beetle*, called by *Ray* the Unicorn-Beetle, speckled with purple, is of the large kind, and the body is of an oblong shape, and pretty thick: the general colour is blackish, with a strong and very fine tinge of glossy purple: the cases of the wings are marked with three lines, each of which is formed by a row of longitudinal, hollow, round spots, and there are about twelve on each row: the lines between them are hollowed. It is found in the same places as the former.

The black *Dung-beetle* with reddish legs, is a small species, being not much bigger than a common fly: the colour of the body is black, and the breast is broad and short: the cases of the wings are streaked each with eight lines, and the legs are of a reddish brown, as are also the

the bases of the feelers. Some authors call it the Burn-cow, or Burn-cow, with a black body and red legs.

Linnæus divides them into two species, namely, the greater or stinking Beetles, and the lesser or rapacious Beetles. Of the stinking Beetles, there are the black stinking Beetle with the cases of the wings convexly streaked: the black stinking Beetle with the cases of the wings greenish, and convexly speckled and streaked: the black stinking Beetle with brassy wings, convexly speckled and streaked: the black stinking Beetle with fifteen streaks on the cases of the wings: the green stinking Beetle with bluntly streaked cases of the wings, and the head and legs of an iron grey colour: the black stinking Beetle with green shallow furrowed wings, and black feelers and legs.

The *Mordella* is an insect of the Beetle kind, with feelers like threads, and have generally legs that serve them for leaping. It is called by the German *Wafferwante*; but we have no *English* name for it: the oblong Black *Mordella*, with a slender pointed tail, is not above a sixth part of an inch in length, and the breadth not half so much: the colour is black, and it is smooth and a little glossy on most part of the surface: the head is small and bent, and the cases of the wings have no streaks; the breast is smooth, and very convex, and the feelers are very slender, truncated, and jointed: the body grows gradually smaller towards the tail, where it terminates in a sharp thorn or prickle, which is black, and reaches longer than the extremity of the wings: the legs are slender and long, by which means it leaps very nimbly.

The roundish opaque black *Mordella* is shorter and thicker than the former, being nearly of a roundish shape: the head is small, and the breast raised, being of a dusky deep black, but not glossy: the cases of the wings are of the same colour, and somewhat shorter than the body, but the legs are slender and long, which enable it to leap very briskly. It is common in gardens.

The shining blue oval-bodied *Mordella*, called by *Ray* the small leaping Capricorn Beetle, is not much larger than a flea, and the body is short, being nearly of an oval form: the breast and back are both very convex and smooth, and of a very deep, beautiful, glossy blue colour: the legs are long, the thighs thick, robust, and whitish, and the lower part of the legs are of an iron-grey colour. It hops very nimbly, and is common among cabbages, while they are young.

The roundish black *Mordella* with a brassy tincture, is much less than a flea, and is all over of a very deep glossy black, with a fine brassy yellowish cast: the belly and legs are of the same fine black, but without the yellow: the cases of the wings are marked with streaks, that consist of five small hollow spots. It may be seen in the gardens early in the spring.

Linnæus has only three kinds, to which he gives no very distinct marks; however there are other species, as the yellow *Mordella*; the roundish mouse-coloured *Mordella*; the roundish black opaque and dotted *Mordella*; the roundish black glossy *Mordella* with yellow feelers and legs: the oblong black *Mordella* with an iron-grey spot on each case of the wings, whose sides are of the same colour towards the base: the oblong black *Mordella* with the cases of their wings yellow down their middle: the reddish-brown *Mordella* with the fore-legs dentated; the

the black Mordella with the cases of the wings red at their extremities: the brown opake Mordella with the cases of the wings speckled: the iron grey brown Mordella, with the breast depressed on the fore part: the Mordella with the joints of a little longish shape, except that at the end, which is perfectly round.

The *Cicindela* has feelers like threads or bristles, prominent dentated jaws, and a roundish breast, though somewhat angular: the Green Beetle with ten white spots of *Ray* is a *Cicindela*, and is a very beautiful insect; the upper surface of the body shining, and variegated with green and gold: the cases of the wings are smooth, glossy, of the same colour, and marked with ten white spots, some of which are roundish, some oblong, and one in the figure of a half moon; likewise the extremities of these cases are white: the breast is narrow, roundish, and of a deep green; the head is small, depressed, and finely tinged with gold colour: the eyes are black and prominent as well as the mouth, and the upper lip is blunt and white: the upper jaws are also prominent, and have several strong teeth therein; but the lower has only one tooth, and that at the extremity: there are two pair of feelers, one of which consists only of two joints, and the other of ten: the legs are very long and slender, and there is a kind of hard oval substance at the base of the thighs. It is common in pasture ground in the spring, and runs and flies very swiftly.

The small gilded Beetle is a small species, and its colour is fine and glossy, resembling a yellow metal with a little mixture of green: the eyes are black and prominent, the breast narrow and rounded; and the cases of the wings are adorned with many broad hollow specks in the centre of each of which there is a prominent point: these hollow specks are placed in rows, and are a deep black; but their bottoms are of a fine metalline yellow. Upon the whole it is a very beautiful insect, and may be easily found on the banks of rivers.

The *Cicindela* with the cases of the wings of a blueish green, and a yellow belly: the body is nearly of an oval shape, and the head, breast, feelers and legs, are all black: the belly is of a yellowish tawny colour, and the cases of the wings of a blue green, variegated with hollow specks: the feelers are slender, and consists of ten joints: this insect is common in the woods.

The black *Cicindela* with the cases of the wings marked with six white spots, and a white streak. It is found in the woods, and runs and flies very swiftly. It is quite black, except the wings, marked as above, and the thighs and feet are long, slender, and a little hairy.

The black *Cicindela* with a red breast, and blackish-blue cases of the wings: this insect has black feelers, of the length of the body, and the head and feet are of the same colour; but the breast is of a reddish brown and the cases of the wings black, with a blueish cast, marked with very small points: the belly is yellow behind, and oblong and narrow.

The *Cicindela* with blueish cases of the wings, and the belly of a fallow colour. It is found at the bottoms of mountains, and in shady places, and is of the same shape as the former: the head, breast, feet, and feelers are black, and the belly, near the feet, is of a fallow colour, but the cases of the wings are of a shining blue, marked with hollow points, and the feelers consist of six joints.

The *Cicindela* with a green breast, with the cases of the wings of an iron grey, but behind of a blueish black: the feelers are black, the body and the breast of a shining blue.

The *Burn-cow*, or *Burſt-cow*, called in Latin *Buprestis*, is an insect with feelers like threads or bristles, and the head half hid within their breast, and of a roundish shape: the yellowish green *Burn-cow* without spots, is placed by some among the *Cantharides*, only it has a more oblong body: the cases of the wings are of a greenish yellow, or rather of a gold colour; the legs are long and thickish, the eyes globous and prominent; and from the forehead near the eyes, there are two oblong horns or feelers, which are articulated: the head is small, the mouth wide, hard, strong, and forked; being armed with teeth, with which it bites very hard: the belly is not round, but longish. It will fight with Beetles and efts, wounding them in the belly. It is about half an inch long, and feeds upon moss, heath, efts, worms, and other insects, which it vanquishes in fight. Nor will it touch any that are killed by other means. *Belonius* describes it thus; it is a winged flying insect, having a most filthy smell, and is like a *Cantharis*, but larger, and is of a yellowish colour, and so very venomous, that horned cattle which feed in pastures where they are, are often killed therewith: this however differs from the former in the colour.

There is another *Burn-cow*, with a shorter body and a broader belly; as also a sharper tail, and a small head, with prominent eyes, and a wide forked mouth: the cases of the wings are streaked lengthways, and the colour is as green as grass, with a mixture of shining gold. It has eight legs, which are long in proportion to the body; but more slender than in the former species, and of a blackish colour, the feelers are more small and slender, and it is as nimble as the first, but has a much more filthy smell. It lives upon flies and palmer worms: these are venomous to cattle like the former; and some affirm if one of them be swallowed it will poison a man.

In Germany there are also two other sorts, the one of a greenish gold colour, and the other of a yellow black: the first is like the former above described, but is a little bigger, and the cases of the wings are streaked with lines of a deep gold-colour, shaded with a little green; and between the lines hollowish tubercles arise, which look as if they were engraved therein. It is very nimble, and in that is like the other kinds: the yellowish-black *Burn-cow* has the same qualities as the former, only it is of a different colour, is a little bigger, and has four feelers.

The brownish brassy *Burn-cow*, is a very small species, though the eyes are pretty large and prominent: the feelers are short, and the breast is short, and broad, but hollowed, and has a very small rim: the cases of the wings are very bright and glossy, and finely streaked with very minute elegant specks: the legs are slender and black, as well as the under part of the body, and the snout is prominent. It is common among the reeds near rivers.

The brassy and clouded *Burn-Cow* with clavated feelers, is also a small species, being hardly so big as a flea: the belly and lowest parts of the body are black; but the upper is all over of a brassy yellow, with a mixture of brown, and it has a brown spot on the back, which touches both the cases of the wings, which are finely streaked:

The breast is marked with five oblique furrows, and is large: the head is almost hid under the breast, and the body grows narrower towards the tail. It does not appear that these two last species are dangerous to cattle.

The *Virginian Burn-cow*, is of a dusky brassy colour, with spots on the wings, and is of a pretty large sort: the head is almost hid under the breast, as in the former kinds, and the breast is of a brassy colour, with a mixture of a reddish brown: the cases of the wings are also of the same colour, but not so much of the red; but they are marked with four or five streaks, and on each there are two spots, so disposed, as altogether to make a square figure when the cases are closed: they are of a bright and clear yellow.

Linnaeus mentions the *Buprestis* with a forked mouth, the greater water *Buprestis*, and the lesser water *Buprestis*.

Water-beetles have generally feelers like bristles, and feet proper for swimming, being a little bearded like an ear of corn, and are six in number, the hinder being a little longer and broader than those before: they never fly in the day time, but in the night, or at least very seldom.

The great *Water-beetle* is an inch and half long, and is all over of a deep, somewhat glossy black: the eyes are pretty large, the feelers short, and the cases of the wings smooth on the surface, and under them there are wings, with a tincture of a silver colour: the body grows smaller, and terminates almost in a point behind it. It is very common in ponds and ditches, and feeds upon the smaller water insects;

The black *Water-beetle* with the cases of the wings that are yellow on the edges, is of the same size with the former; but the head is small in proportion to the body: the eyes are large, and the legs strong and robust; the edges of the cases of the wings are very prominent, especially about the middle, where they are of a yellow colour; but every other part is black. It is common in rivers and brooks.

The goggle eyed *Water-beetle* is not quite so large as the two preceding, but it has a big head, and the eyes are very prominent: the cases of the wings are marked with ten streaks, which do not run through the whole length, for they are smooth near the end: the streaks are very deep, and the colour all over is of a blackish brown.

The grey *Water-beetle* is not much bigger than the blue flesh fly, and its breast is yellow in the middle, though black at the top and bottom: the cases of the wings are of a greyish colour, and are marked with a great number of shining specks of a yellowish colour; and at the edges they are entirely yellow: there is also a yellow spot in the shape of a heart, with black edges on the top: the point of the breast is blunt, though a little forked.

Linnaeus takes notice of the *Water-beetle* with perfoliated feelers, of that with dilated sides, of the common *Water-beetle*; and of the *Water-flea*: these last are remarkable for skipping up and down upon the water, as if they were at play; but when the water is troubled, they sink to the bottom, or hide themselves in the holes of the banks.

The other species are the *Water-beetle* with a yellow breast, that with brown wings and a black belly: the *Water-beetle* with a round body, marked with ten streaks on the cases of the wings: the oval-bodied *Water-beetle*, with the cases of the wings and breast black, but

the head and legs reddish: the brown oval Water-beetle with reddish legs, head, and breast.

Another insect of the Beetle kind, is by modern authors called *Elater*, which has feelers like bristles, and an oblong body. It is remarkable, that when laid on its back, it has the power of springing or leaping up, whence it has its name; for *Elater* signifies a spring.

The *Elater* of a mixed brown, green, and brassy colour, is a small species, and has an oblong body: the breast and cases of the wings of the male are very bright, abounding pretty much with green, and the feelers are a little pectinated on the sides: the colour of the female is more yellow, and the breast is broader and glossy, being more green than the wings, but the feelers are not pectinated. It makes its appearance chiefly in *June*.

The black *Elater* with a red breast, is of the smallest species, and is all over black, except on the breast and the cases of the wings, which are of a blueish cast; likewise the forepart of the breast is black, and the other red, and has the appearance of a large red spot, in the shape of a half moon, the horns of which are turned towards the head: the feelers are black. It is very common in pasture-grounds under hedges, near *London*.

The brownish black *Elater*, is a pretty large species, and has an oblong body: the colour is the same throughout, being of a brownish black; but the head is small, and the cases of the wings are smooth, and a little glossy.

This is called the brown *Notopeda* by *Linnaeus*; who also takes notice of the black *Elater* with a hairy breast; the black *Elater* with a red breast, mentioned above; and the black *Elater* with red cases of the wings. Other authors mention the greenish brassy-coloured *Elater*, with yellow legs: the black *Elater* with cases of the wings blue: the black *Elater* with cases of the wings red on the back part: the black *Elater* with the cases of the wings livid on the outer edge: the red-breasted *Elater* with red cases of the wings: the black *Elater* with brown cases of the wings, and the feelers and legs of a reddish brown.

The *Cantharis* is of the beetle kind, from whence comes *Cantharides*, well known in the shops by the name of *Spanish flies*, and for their use in blisters: they have feelers like bristles, flexible cases of the wings, a breast pretty plain, and the sides of the belly wrinkled.

Cantharides differ from each other in their size, shape and colour; those used in the shops also do the same: the largest in these parts are about an inch long, and as much in circumference; but others are not above three quarters of an inch. Some are of a pure azure colour, others of that of pure gold, and others again have a mixture of gold and azure-colours; but they are all very brilliant, and extremely beautiful.

There are four parts in this insect, namely the head, the neck or breast, the body, and the belly: the head is small in proportion, but the mouth is pretty large, and there are teeth in the jaws, with two sorts of articulated pinchers, with which they lay hold of the food and bring it to their mouth; on the forehead there are two eyes of a golden colour, a little prominent, and under them there are two horns or feelers, made like bristles, pretty long, and moveable, by means of twelve equal articulations, the last of which terminates in a point: the

top of the head rises in a bump, is extremely smooth and polished, and divided into two parts. Instead of a chin there is a beard, and the breast is formed of a single plate, behind which are a sort of lungs, and it is connected below to the first pair of feet, which are each composed of three parts, much of the same length, of which the last has five knotted joints, terminated with two crooked claws: the cases of the wings are membranous, are connected to the breast, and are as it were shagreened; they are more long than broad, convex above, and hollow beneath; they are thin, but strong, and cover the upper part of the body, to which below the two last pair of feet are connected: the belly consists of six large rings, that are smooth and folded at the sides: they are seemingly without hair, but examined with a microscope they appear a little hairy, especially in the under part: the body, properly so called, is composed of eight moveable rings, which are furrowed from one end to the other: they are bred from worms shaped almost like real Caterpillars. These flies are most common in the hot countries, such as *Spain, Italy*, and the southern parts of *France*; however there are some in all parts of *Europe* at certain times of the year.

The *Glow-worm* is by *Dale* affirmed to be the female of the *Cicindela*, from the experience and examination of a physician in his neighbourhood. It has indeed no wings at all, and is consequently a creeping insect; but as it is a female of one of the Beetle kind, it could not be well omitted in this place: the shield and shape of the breast, as well as the folds and wrinkles of the body, plainly shew that she belongs to this kind: the body has eleven joints, or rather incisures, the first of which lies on the shield of the breast, and is of a half oval shape, flattened, marginated, and truncated at the hinder part: the head is placed under this, and is very small; and the three last joints of the body are of a yellowish colour, which shine or look like fire in the dark. It is often seen under hedges by travellers in the night, and if carefully taken up and laid upon a grassy turf, will continue to shine for several nights.

The *Cantharis* with blackish cases of the wings, and a red breast, is of the largest kind, being above an inch and a half long, and about a quarter of an inch in diameter. It is softer to the touch than most other insects of the Beetle kind, and has a flattish head and back, except under the eyes, where it is a little reddish: the mouth is small and forked, and the feelers at the mouth are very short and small; but there are others half the length of the body, and consist of eleven joints, reddish near the root, and brown every where else: the breast is depressed behind, and in the shape of a heart; but the edges are somewhat prominent, and the whole is reddish, except a black spot on the upper part, close to the head: the cases of the wings are plain, smooth, and oblong, but very soft and flexible, feeling like silk, and of a brownish black colour: the body is brown, except the last joint, which is reddish, and there is a tincture of the same colour along the sides, which are compressed all the way: the joints are folded in some sense over each other, and their extremities are soft, being covered with a sort of pimples. It is common about houses in the country, and under hedges.

The red-breasted *Cantharis* with red cases of the wings, is a small sort, having a black body, and the cases of the wings of a bright ele-

gant red, as well as the breast, only there is a black spot thereon: the feelers are slender, and the cases of the wings are very soft, silky, and flexible, and the wings are thin and brown. This is not very common with us.

The *Cantharis* with black cases of the wings marked with two red transverse lines, is not much bigger than a louse, and the legs and feelers are black, but the head and breast of a greenish colour: the cases of the wings are of a deep glossy black, marked with two transverse red streaks, one of which is near the base, and the other near the point or extremity: the sides of the body are reddish. It is not uncommon under hedges and pasture grounds.

Linnaeus takes notice of ten sorts of *Catharides*; the first of which he calls the Female *Cantharis*, without wings, and it is usually found upon juniper trees. He says he has never seen the male, though he does not question but there is one, because this shines in the night time, as he thinks with an intent to let the males know where to find her: this is the same as the Glow-worm, and in some measure confirms what Dale has said about her.

2. The *Cantharis* with testaceous cases of the wings, and a red breast without spots. It is found in the same places as the former, and is of the same shape and size, resembling it in all things except the colour of the cases of the wings, which are of a pale yellow colour; likewise the breast is without spots, and the eyes are black.

3. The *Cantharis* with black cases of the wings, and a red breast marked with a white spot. It is called the Tree-beetle by some, of a blackish-brown colour, with slender cases of the wings.

4. The *Cantharis* with red cases of the wings, and a red breast marked with a black spot; this is found in different places, and sometimes among heaps of iron ore: it is less by one half than the former, and the body is entirely black: the feelers are very slender, and the cases of the wings are of a deep red, of saffron colour, slightly streaked, but the wings themselves are brown.

5. The green copper coloured *Cantharis* with the cases of the wings red on the outside: this is found on large nettles, and other plants; it is of a middle size, and has the head, breast, feelers, the rings of the belly, the lower part of the cases of the wings, and the inner edges, of a greenish copper-colour; but the hinder part of the cases of the wings near the point, as well as the sides, are red, and the remainder of a greenish copper-colour; but the wings themselves are brown.

6. The *Cantharis* of a greenish copper colour, with the point of the cases of the wings red, is much smaller than the former, and the wings are of a blackish brown, and the feelers quite black: the breast, head, and cases of the wings, are of a deep green, inclining to a copper-colour, with red or saffron coloured points: the belly is longer than the cases, and beneath is of a copper colour; but the inside of the wings are red: this sort varies with regard to the cases of the wings, which are sometimes blue, and at other times red.

7. The *Cantharis* with black cases of the wings, marked with two red streaks, is no larger than a louse: the head and the breast are green,

8. The *Cantharis* with black cases of the wings with yellow points; and a black breast, is of the size of the former, but the head and the breast

breast are quite black: the end of the cases of the wings is yellow, or of the colour of sulphur, and the sides of the belly are yellow.

9. The brown *Cantharis* with the cases of the wings yellow at the point, and a red breast. It is of the size of a louse, and the breast is of a rusty red, with a black spot; the cases of the wings are brown, and do not reach half way on the belly; but their points are yellow: the thighs are black, the legs pale, and the segment on the belly yellow on the edges.

10. The black *Cantharis* with livid cases of the wings, is the least of these kind of flies, and is found upon plants.

Moufet informs us that the *Cantharides* of the shops, have a pretty large, oblong, thick body, not much unlike a grain of wheat, and that there are transverse gold-coloured lines on the cases of the wings; but these lines are not common to all, for in some they are of a shining green, and in others of a murrey or ruddy colour; but they have all a sort of splendor, and are agreeable to look upon: that they live upon pulse and corn, particularly wheat, in which last case, he affirms their virtues are most considerable: they smell like tar, and taste like cedar-wood. As for their use in medicine, it is too well known to insist upon it in this place.

The *Stinking Beetle*, called by some the *Tenerio*, from its hating the light, is a pretty large insect, which is all over of a coal black: the body is of such a form, that any one would conclude it was a winged insect, and that it had cases for wings; and yet *Moufet* assures us, that upon examination he could not find any, though by some it is called the black *Tenebrio* with accumulated wings: the legs and thighs are slender, and the feelers are pretty long, being composed of joints, which are longish, except the last, that is round: the breast is marked with small specks, and has a rim. What some take for the cases of the wings, are wrinkled: it walks very slowly, and keeps in the deep holes of dunghills in the day time, but comes out in the night: it has a filthy smell, which is very nauseous in places where they abound: it is a solitary animal, for even so much as two are seldom or never seen together.

The black *Tenebrio* with the cases of the wings rounded behind, is a pretty large insect, and has a back a little prominent, with a small head, and long legs. It is all over of fine deep black, with a purplish cast, and is frequent about the hot-beds in gardens.

The black *Tenebrio* with prominent jaws, is not much bigger than a common fly, and the colour is of a deep dull black: the legs are long, and the feelers slender, and pretty long: it may be found on the half-rotten branches of trees. *Linnæus* tells us, that this kind of insect has feelers like small threads, and that the upper part of the body, which appear like cases of the wings, are united together; for they have no wings at all; though it must be observed, that he mentions no more than the Stinking Beetle.

The *Oil-Beetle*, called by *Moufet* and *Linnæus* the *Proscarabæus*, has a soft body, of a dusky-blue colour, with a shining blackish cast. On the shoulders there are two wings, or rather the rudiments of wings, which it makes use of much like Ostriches, to help their running, and not for flying: the circles which surround their backs and bellies in the young, are greenish, but in the adult more blue: upon the slightest motion

motion or touch, they shed a sort of an oil, not unlike liquid honey. *Mouset* informs us, it is never seen except in *May*; but since the change of the *stile*, it may now appear in the beginning of *June*.

Linnaeus affirms, that the feelers are like small threads, and it has no wings, but there are a sort of cases for them, not above half as long in proportion, as in others of the Beetle kind.

The *Necydalis*, so called by *Linnaeus*, is an insect of the Beetle kind, with feelers like bristles, and the cases of the wings that reach but half way, leaving the rings partly naked. He has only one sort, which he calls the *Necydalis* with globous knees. Another author says it is hardly bigger than a louse, but has a small black head, with yellow jaws, and a yellow breast; that the cases of the wings are black, excepting the middle, where they are brownish, and a yellow spot at the extremities. The wings themselves are black, and twice the length of the cases, lying one over another like a cross. The feelers are almost as long as the body, and are yellowish, at the base, but black elsewhere: the body is brown, with a yellowish cast on the sides, and the lower part of the legs are also yellowish: this insect is not commonly met with.

The *Necydalis* with a white line on the extremities of the cases of the wings, has a black head and breast, and is of an oblong, but somewhat depressed shape: there are two white spots on the breast, and the cases of the wings are grey, being scarce half so long as the body: the wings themselves are half naked, and the feelers are twice as long as the body, and of a grey colour: the legs are also grey, and thick in the upper part: they are often met with in hedges.

The *Ear-wig*, is called by *Linnaeus Forficula*, and has feelers like bristles, a forked tail, and cases of the wings which reach but half way, though they entirely cover the wings themselves: the feelers consist of thirteen or fourteen joints, and the covering of the breast is flat, it being truncated on the fore part, rounded behind, black in the middle, and paler about the edges: the cases of the wings are of a pale reddish brown, and at the extremity of the wings themselves there is a white oval spot: the body is of a reddish-brown: this is a very common insect, and generally known: there is another sort, about half the size of the former, but in other respects differs very little from it.

The *Staphylinus*, so called by *Linnaeus*, is an insect of the Beetle kind, with feelers like threads, and two vesicles over the tail: the cases of the wings reach but half way, and the wings themselves are covered.

Linnaeus mentions fifteen sorts of these insects, namely,

1. The hairy black *Staphylinus* with the throat and lower belly yellow. It is very common in Friezland.
2. The hairy ash-coloured *Staphylinus* clouded with black, is found in horse dunghills.
3. The black smooth *Staphylinus* with jaws as long as the head. It is called by *Lisler* the greater black Beetle, with biting nippers; and by *Ray* the *Staphylinus* that is entirely black: this seems to be the same as one hereafter mentioned. It lives in woods upon insects.
4. The black *Staphylinus* with red cases of the wings and feet. It is found in dunghills.
5. The black *Staphylinus* with a brass-coloured shining breast, and the cases of the wings of a blackish-blue.

6. The reddish *Staphylinus* with a head, wings, and hinder part of the belly black.

7. The dusky *Staphylinus* with the future of the cases of the wings, the belly and feet of an iron-grey colour. It is found among rotten wood.

8. The black smooth *Staphylinus* with red feet.

9. The black smooth *Staphylinus* with red feet, and the edges of the cases of the wings yellow: this is a very small insect, being no bigger than a flea.

10. The black *Staphylinus*, with the cases of the wings grey on the fore part, and red legs. It is found in moist sand on the banks of rivers, where it produces its young.

11. The black *Staphylinus* with blood-coloured cases of the wings. It is found in no particular place, but in all alike.

12. The testaceous *Staphylinus*, so called by a Swedish naturalist, is found on plants and dunghills.

13. The black *Staphylinus* with the breast, cases of the wings, and feet, a little testaceous.

14. The black *Staphylinus* with the cases of the wings, feelers and feet, of an iron-grey colour.

15. The black *Staphylinus* with the cases of the wings and legs of a dusky colour.

The common *Staphylinus* with long jaws, is about an inch in length, and the head, breast, and cases of the wings, are of a shining black, and smooth, though the cases are sometimes variegated with grey: the body is of a deep black, but not very glossy, and the legs are long and black; and there are two hard, long, very sharp horns, on the forehead. It is common under shady hedges.

The reddish-brown *Staphylinus* is about the size of a common Ant, and the body is of a pale red, with a little mixture of brown, but the head, and the three or four last rings of the body are black: the cases of the wings are of a deep blue, and the legs reddish, with black joints: the feelers consist of eleven joints, and are of a pale colour, except at the ends, where they are black. It is sometimes met with near the banks of brooks and rivers.

The hoary *Staphylinus* has an oblong body, of a greenish colour, with a brassy cast, and clouded with black spots: the head is large, and somewhat flat, and the mouth is forked; the feelers consist of nine joints, and the cases of the wings are short, of a greyish-black colour, with a brassy cast: the tail is furnished with two plumous hairs, and on pressing the body, two white hooks will be thrust out from the tail. It is an inhabitant of the dunghills.

The black *Staphylinus* is about half an inch in length, and has a long flattish body, with a black glossy head: the cast of the wings are of a deep blue, with a mixture of black, and are bright and glossy: they have a metalline cast, and have many small specks: the feelers consist of nine joints; but the principal distinction is the spots on the breast, which are ten in number, and a little hollowed. It may be sometimes met with among decayed trees in the woods.

The *Mill-beetle*, has feelers like bristles, two horns on the tail, membranous cases of the wings, and a flattish, roundish, marginated breast. It is of the size of a Cricket, and is of a deep iron colour, approaching

to black: the shield that lies over the breast is plain and oval, and the cases of the wings are also of an oval shape; they are somewhat shorter than the body, and a little transparent: there are three streaks upon each, the middlemost of which is raised, and the more inward hollow and crooked: there are two prickles on the tail, and the legs are also prickly: the female has only the rudiments of the wings, and their cases. It never appears in the day time, and therefore is said to be a hater of the light. It is very common in mills and bakers houses. *Linnaeus* calls this a *Blatta*.

The yellow *Blatta* is not much larger than a fly, and the shield that covers the breast is membranaceous, of an oval shape, and marginated. The cases of the wings are membranaceous and transparent, of a brownish colour, and have raised streaks, with black spots thereon: the legs look like horns, and are prickly, and the feelers are long; there are also two articulated horns or prickles above the vent. It is not met with in *England*, but is common in *Lapland*, for which reason, it is called by *Linnaeus* the *Lapland Blatta*.

The American *Blatta* or *Cock-roach*, is of a reddish-brown colour. It is a very troublesome destructive insect, and are so numerous and voracious, that it is impossible to keep victuals of any kind from being devoured by them, without close covering: they eat not only leather, but linen and paper: they disappear in winter, and are most numerous in the hottest days of summer; but what mischief they do is chiefly in the night. These insects lay their eggs in heaps, which they wrap all round in a bag or web, in the manner of some spiders. When the eggs are hatched, the young ones appear quite perfect, and run out of their shells very nimbly. At first they are no bigger than Ants, for which reason they creep through cracks and key-holes, and into boxes and chests, where they gnaw and spoil every thing they can come at. They have two very long horns or feelers, six hairy legs, with two claws at the ends like forks, and the head is black, with a reddish round circle on the upper parts. When it is arrived at its full growth, it casts its skin, which bursts on its back, and then the Cock Roach is perfectly formed. The wings are soft and tender, being at first whitish, and after of a reddish colour; but the head, horns, and the remaining parts, are of the same shape and colour as before its skin was thrown off.

The insects that *Linnaeus* places under the name of *Gryllus*, has bristly feelers, membranaceous covers of the wings, which are narrow, and in the shape of the insects of the Flie kind, and their legs are proper for leaping.

The *House-cricket* is a very inoffensive and pretty animal. Though there be a species of this insect that lives entirely in the woods and fields, yet that with which we are best acquainted is the House-cricket, whose voice is so well known behind a country fire in a winter's evening. There is something so unusual in hearing a sound while we do not see the animal producing it, nor discover the place from whence it comes, that among the country people the chirping of the cricket is always held ominous; and whether it deserts the fire-side, or pays an unexpected visit, the credulous peasantry always find something to be afraid of. In general, however, the killing of a cricket is considered as a most unlucky omen; and though their company is not much desired, yet no methods must be taken to remove them.

The cricket very much resembles the grasshopper in its shape, its manner of ruminating, its voice, its leaping, and methods of propagation. It differs in its colour, which is uniformly of a rusty brown; in its food, which is more various; and in its place of residence, which is most usually in the warmest chinks behind a country hearth. They are, in some measure, obliged to the bad masonry employed in making peasants houses for their retreats. The smallest chink serves to give them shelter; and where they once make their abode they are sure to propagate. They are of a most chilly nature, seldom leaving the fireside; and, if undisturbed, are seen to hop from their retreats, to chirrup at the blaze in the chimney. The wood-cricket is the most timidous animal in nature; but the chimney-cricket, being used to noises, disregards not only those, but the appearance of people near it. Whether the voice of this animal is formed in the same manner with that of the grasshopper, by a fine membrane at the base of the wings, which is moved by a muscle, and which being coiled up, gives a sound like a quail-pipe is not yet ascertained; nor do we well know the use of this voice, since anatomical inspection has not yet been able to discover the smallest organs of hearing. Still, however, we can make no doubt of their power of distinguishing sounds, though probably not in the same manner with the more perfect ranks of Nature. Certain it is that I have often heard them call, and this call was as regularly answered by another, although none but the males are vocal.

As the cricket lives chiefly in the dark, so its eyes seem formed for the gloominess of its abode; and those who would surprise it, have only to light a candle unexpectedly; by which it is dazzled, and cannot find the way back to its retreat. It is a very voracious little animal, and will eat bread, flower, and meat; but it is particularly fond of sugar. They never drink, but keep for months together at the back of the chimney, where they could possibly have had no moisture. The warmth of their situation only serves to increase their mirth and loquacity. Except in the very coldest weather, they never cease their chirruping, but continue that little piercing note, which is as pleasing to some as it is disagreeable to others. The great Scaliger was particularly delighted with the chirruping of crickets, and kept several of them for his amusement, enclosed in a box, which he placed in a warm situation. Others, on the contrary, think there is something ominous and melancholy in the sound, and use every endeavour to banish this insect from their houses. Ledelius tells us of a woman who was very much incommoded by crickets, and tried, but in vain, every method of banishing them from her house. She at last accidentally succeeded; for having one day invited several guests to her house, where there was a wedding, in order to increase the festivity of the entertainment, she procured drums and trumpets to entertain them. The noise of these was so much greater than what the little animals were used to, that they instantly forsook their situation, and were never heard in that mansion more.

The *Field Cricket* is of a blackish colour, and the male has a longer body than the female; the head in proportion to the body, is large, and the eyes big and prominent: the forehead is furnished with two feelers without joints, but it can turn them any way it pleases: it has six feet or legs, the same colour as the body, and those behind are the longest, that it may leap the better: the wings seem to be lightly varie-

gated with sculptures, seeming almost to cover the whole body, and the tail is forked: the bulk of the body of the male is less than that of the female, for this last has a larger belly, and grass-green eyes, with red feelers, and a tail like a trident: they are found in the fields in the summer time, making holes in the ground, where they build their nest, and where they lie concealed in a mild winter, but in one that is severe, they die in their holes: they make a particular sort of noise with their wings, which is plain from this; namely, that when their wings are taken off the noise ceases: they sing day and night, and they delight in the sun, sitting at the mouths of their holes. They frequent pasture-grounds and meadows that are quite open, for they shun shady places. They sing most when people are at a distance, for when they come near they are silent, and get into their holes.

The *Water Cricket* has a five cornered head, with prominent globous black eyes, but not large; near the mouth there are very short feelers, and there are three feet on each side; but the hindermost are much the longest: the wings are on the back, or at least the rudiments of them, and the tail is forked: the body is of a brownish colour, or rather of a whitish black. It differs from the land Cricket in having a more prominent head, and somewhat of a neck: the wings seem likewise to be useless for flying, though they help to raise this insect up. It is commonly seen sitting upon water-plants, and is said to sing like the land Crickets.

But of all the cricket kind, that which is called the *Mole-Cricket* is the most extraordinary. This animal is the largest of all the insects with which we are acquainted in this country, being two inches and a half in length, and three quarters of an inch in breadth. The colour is of a dusky brown; and at the extremity of the tail there are two hairy excrescences, resembling in some sense the tail of a mouse. The body consists of eight scaly joints or separate folds, is brown on the upper part, and more deeply tinged below. The wings are long, narrow, and terminate in a sharp point, each having a blackish line running down it: however, when they are extended, they appear to be much broader than could at first sight be supposed. The shield of the breast is of a firm texture, of a blackish colour and hairy. The fore-feet, which are this animal's principal instruments of burrowing into the earth, are strong, webbed, and hairy; it generally, however, runs backward; but it is commonly under ground, where it burrows even faster than a mole. It is thought also to be amphibious; and capable of living under water, as well as under ground.

Of all insects this is the most detested by gardeners, as it chiefly resides in that ground which lies light, and where it finds sufficient plenty under the surface. Thus, in a single night's time, it will run along a furrow which has been newly sown, and rob it of all its contents. Its legs are formed in such a manner that it can penetrate the earth in every direction; before, behind, and above it. At night it ventures from its under ground habitation, and, like the cricket, has its chirping call. When the female is fecundated, she makes a cell of clammy earth, the inside of which is large enough to hold two hazle-nuts; and in this she lays her eggs. The whole nest is about the size of a common hen's egg, closed up on every side, and well defended from the smallest breath of air. The eggs generally amount to the number of

an hundred and fifty, being white, and about the size of a carraway-comfit. They are thus carefully covered, as well to defend them from the injuries of the weather, as from the attacks of the black-beetle; that being itself an under ground inhabitant, would, but for this precaution, devour or destroy them. To prevent this, the female mole cricket is often posted as a sentinel near the nest, and when the black invader plunges in to seize its prey, the guardian insect seizes him behind, and instantly bites him in two.

Nothing can exceed the care and assiduity which these animals exhibit in the preservation of their young. Wherever the nest is placed, their seems to be a fortification, avenues, and entrenchments, drawn round it: there are numberless winding-ways that lead to it, and a ditch drawn about it, which few of its insect enemies are able to pass. But their care is not confined to this only; for at the approach of winter they carry their nest entirely away, and sink it deeper in the ground, so that the frost can have no influence in retarding the young brood from coming to maturity. As the weather grows milder, they raise their magazine in proportion; till, at last they bring it as near the surface as they can, to receive the genial influence of the sun, without wholly exposing it to view: yet, should the frost unexpectedly return, they sink it again as before.

Belonging to the second order of insects, we find a tribe of little animals, which, though differing in size and colour, strongly resemble each other in figure, appetites, nature, and transformation. But though they all appear of one family, yet man has been taught to hold them in different estimation; for while some of this tribe amuse him with their chirpings, and banish solitude from the fields, others come in swarms, eat up every thing that is green, and in a single night convert the most delightful landscape into a dreary waste. However, if these animals be separately considered, the devouring locust is not in the least more mischievous than the musical grasshopper; the only difference is, that one species come for food in a swarm, the other feeds singly.

That animal which is called the *grasshopper* with us, differs greatly from the *cicada* of antiquity; for as our insect is active enough in hopping through the long grass, from whence it has taken its name, the *cicada* had not this power, but either walked or flew. The little hissing note also of our grasshopper is very different from the song of the *cicada*, which was louder and far more musical. The manner in which this note is produced by the two animals is very different; for the *cicada* makes it by a kind of buckler, which the male has beneath its belly; the grasshopper by a transparent membrane that covers an hole at the base of its wings. There is still a greater variety in all these with regard to shape and colour. Some are green, some black, some livid, and some variegated; but many of them do not shew all their colours till they fly. Some have long legs, some short; some with more joints, others with fewer. Some sing others are mute; some are innocent, doing no damage to the husbandman; while others do such prodigious mischief, that they are looked upon in some countries as one of the terrible scourges of the incensed Divinity.

Of this variegated tribe, the little grasshopper that breeds in such plenty in every meadow, and that continues its chirping through the

summer, is best known to us; and by having its histroy we shall be posseſſed of that of all the reſt. This animal is of the colour of green leaves except a line of brown which streaks the back, and two pale lines under the belly and behind the legs. It may be divided into the head, the corslet, and the belly. The head is oblong, regarding the earth, and bearing ſome reſemblance to that of a horſe. Its mouth is covered by a kind of round buckler jutting over it, and armed with teeth of a brown colour, hooked at the points. Within the mouth is perceivable a large reddish tongue, and fixed to the lower jaw. The feelers or horns are very long, tapering off to a point; and the eyes are like two black ſpecks, a little prominent. The corslet is elevated, narrow, armed above and below, by two ſerrated ſpines. The back is armed with a ſtrong buckler, to which the muſcles of the legs are firmly bound, and round these muſcles are ſeen the veſſels by which the animal breathes, as white as ſnow. The laſt pair of legs are much longer and stronger than the firſt two pair, fortified by thick muſcles, and very well formed for leaping. It has four wings; the anterior ones ſpringing from the ſecond pair of legs, the poſterior from the third pair. The hinder wings are much finer and more expansive than the moſt, and are the principal instruments of its flight. The belly is conſiderably large, composed of eight rings, and terminated by a forkey tail, covered with down, like the tail of a rat. When examined internally, beſides the gullet, we diſcover a small ſtomach; and behind that a very large one, wrinkled and furrowed within ſide: lower down there is ſtill a third; ſo that it is not without reaſon that all the animals of this order are ſaid to chew the cud, as they ſo muſh reſemble ruminant animals in their internal conformation.

A ſhort time after the graſhopper assumes its wings, it fills the meadows with its note; which like that among birds, is a call to courtſhip. The male only of this tribe is vocal; and, upon examining the baſe of the wings, there will be found a little hole in its body, covered with a fine transparent membrane. This is thought, by Linnæus, to be the instrument it employs in ſinging; but others are of opinion the ſound is produced by rubbing its hinder legs againſt each other: however this be, the note of one male is ſeldom heard, but it is returned by another; and the two little animals, after many mutual insults of this kind, are ſeen to meet and fight deſperately. The female is generally the reward of victory; for, after the combat, the male feizes her with his teeth behind the neck, and thus keeps her for ſeveral hours, till the buſineſs of fecundation is performed. They are at that time ſo ſtrongly united, that they can ſcarcely be ſeparated without tearing aſunder. Towards the latter end of autumn the female prepares to deſtitute her burthen; and her body is then ſeen greatly diſtended with her eggs, which ſhe carries to the number of one hundred and fifty. In order to make a proper lodgement in the earth for them, Nature has furnished her with an instrument at her tail, ſomewhat reſembling a two-edged ſword, which ſhe can ſheathe and unsheathe at pleasure; with this ſhe pierces the earth as deep as ſhe is able; and into the hole which her instrument has made, ſhe deſtitutes her eggs, one after the other.

Having thus provided for the continuation of her poſterity, the animal herſelf does not long ſurviue; but, as the winter approaches, ſhe dries

dries up, seems to feel the effects of age, and dies from a total decay. Some, however, assert, that she is killed by the cold; and others, that she is eaten by worms: but certain it is, that neither the male, nor female are ever seen to survive the winter. In the mean time the eggs which have been deposited, continue unaltered, either by the severity of the season, or the retardation of the spring. They are of an oval figure, white, and of the consistence of horn: their size nearly equals that of a grain of anise: they are enveloped in the body within a covering, branched all over with veins and arteries; and when excluded, they crack, on being pressed between the fingers; their substance within is a whitish, viscous, and transparent fluid. In this manner they remain deposited beneath the surface of the earth, during the whole winter; till the genial return of spring begins to vivify and hatch them. The sun, with its warmth, beginning to animate all Nature, the insect eggs feel its benign influence; and generally, about the beginning of May, every egg produces an insect, about the size of a flea. These at first are of a whitish colour; at the end of two or three days they turn black; and soon after they become of a reddish brown. They appear, from the beginning, like grasshoppers wanting wings; and hop among the grass as soon as excluded, with great agility.

Yet still they are by no means arrived at their state of full perfection; although they bear a strong resemblance to the animal in its perfect form. They want, or seem to want the wings, which they are at last seen to assume; and can only hop among the grass, without being able to fly. The wings, however are not wanting, but are concealed within four little bunches, that seem to deform the sides of the animal: there they lie rolled up in a most curious manner; and occupying a smaller space than one would conceive who saw them extended. Indeed, all insects, whatever transmutations they seem to undergo, are yet brought forth with those very limbs, parts and wings, which they afterwards seem to acquire. In the most helpless caterpillar, there is still to be seen the rudiments of that beautiful plumage which it afterwards expands when a butterfly: and though many new parts seem unfolded to the view, the animal acquires none but such as it was from the beginning possessed of. The grasshopper, therefore, though seemingly without wings, is in reality, from the first, possessed of those instruments, and only waits for sufficient force to break the bonds, that hold them folded up, and to give them their full expansion.

The grasshopper, that for above twenty days from its exclusion has continued without the use of its wings, which are folded up to its body, at length prepares for its emancipation, and for a life of greater liberty and pleasure. To make the proper dispositions for the approaching change, it ceases from its grassy food, and seeks about for a convenient place; beneath some thorn or thistle, that may protect it from an accidental shower. The same laborious writhings and workings, heavings and palpitations, which we have remarked in every other insect upon an approaching change, are exhibited in this. It swells up its head and neck; it then seems to draw them in again; and thus alternately, for some time, it exerts its powers to get free. At length, the skin covering the head and breast is seen dividing above the neck; the head is seen issuing out first from the bursting skin; the efforts still continuing, the other parts follow successively; so that the little animal, with its

its long feelers, legs and all, works its way from the old skin, that remains fixed to the thistle or the thorn. It is, indeed, inconceivable how the insect can thus extricate itself from so exact a sheath as that which covered every part of its body.

The grasshopper, thus disengaged from its outer skin, appears in its perfect form ; but then so feeble, and its body so soft and tender, that it may be moulded like wax. It is no longer of that obscure colour which it exhibited before, but a greenish white, which becomes more vivid as the moisture on the surface is dried away. Still, however, the animal continues to shew no signs of life, but appears quite spent and fatigued with its labour for more than an hour together. During this time, the body is drying, and the wings unfolding to their greatest expansion, and the curious observer will perceive them, fold after fold, opening to the sun, till at last they become longer than the two hinder legs. The insect's body also is lengthened during this operation, and it becomes much more beautiful than before.

These insects are generally vocal in the midst of summer, and they are heard at sunsetting much louder than during the heats of the day. They are fed upon grafts ; and, if their belly be pressed, they will be seen to return the juices of the plants they have last fed upon. Though unwilling to fly, and slow in flight, particularly when the weather is moist or cool, they are sometimes seen to fly to considerable distances. If they are caught by one of the hinder legs, they quickly disengage themselves from it, and leave the leg behind them. This, however, does not grow again, as with crabs or spiders ; for as they are animals but of a single year's continuance, they have not sufficient time for repairing those accidental misfortunes. The loss of their leg also prevents them from flying ; for being unable to lift themselves in the air, they have not room upon the ground for the proper expansion of their wings. If they be handled roughly, they will bite very fiercely ; and when they fly, they make a noise with their wings. They generally keep in the plain, where the grafts is luxuriant, and the ground rich and fertile ; there they deposit there eggs, particularly in those cracks which are formed by the heat of the sun.

Such are the habits and nature of those little vocal insects, that swarm in our meadows, and enliven the landscape. The larger kinds only differ from them in size, in rapidity of flight, and the powers of injuring mankind, by swarming upon the production of the earth. The quantity of grafts which a few grasshoppers that sport in the fields can destroy is trifling ; but when a swarm of locusts, two or three miles long, and several yards deep, settle upon a field, the consequences are frightful. The annals of every country are marked with the devastation which such a multitude of insects produces ; and though they seldom visit Europe in such dangerous swarms as formerly, yet, in some of the southern kingdoms, they are still formidable. Those which have at uncertain intervals visited Europe, in our memory, are supposed to have come from Africa, and the animal is called the great Brown Locust. It was seen in several parts of England in the year 1748, and many dreadful consequences were apprehended from its appearance. This insect is about three inches long ; and has two horns or feelers, an inch in length. The head and horns are of a brownish colour ; it is blue about the mouth, as also on the inside of the larger legs. The shield

field that covers the back is greenish ; and the upper side of the body brown, spotted with black, and the under side purple. The upper wings are brown, with small dusky spots, with one larger at the tips ; the under wings are more transparent, and of a light brown, tinctured with green, but there is a dark cloud of spots near the tips. This is that insect that has threatened us so often with its visitations ; and that is so truly terrible in the countries where it is bred. There is no animal in the creation that multiplies so fast as these, if the sun be warm, and the soil in which their eggs are deposited be dry. Happily for us, the coldness of our climate, and the humidity of our soil, are no way favourable to their production ; and they are but the animals of a year, they visit us and perish.

The Scripture, which was written in a country where the locust made a distinguished feature in the picture of Nature, has given us several very striking images of this animal's numbers and rapacity. It compares an army, where the numbers are almost infinite, to a swarm of locusts : it describes them as rising out of the earth, where they are produced ; as pursuing a settled march to destroy the fruits of the earth, and co-operate with Divine Indignation.

When the locusts take the field, as we are assured, they have a leader at their head, whose flight they observe, and pay a strict attention to all his motions. They appear, at a distance, like a black cloud, which, as it approaches, gathers upon the horizon, and almost hides the light of the day. It often happens that the husbandman sees this imminent calamity pass away without doing him any mischief ; and the whole swarm proceed onward, to settle upon the labours of some less fortunate country. But wretched is the district upon which they settle : they ravage the meadow and the pasture ground ; strip the trees of their leaves, and the garden of its beauty : the visitation of a few minutes destroys the expectation of a year ; and a famine but too frequently ensues. In their native tropical climates they are not so dreadful as in the more southern parts of Europe. There, though the plain and the forest be striped of their verdure, the power of vegetation is so great, that an interval of three or four days repairs the calamity : but our verdure is the livery of a season ; and we must wait till the ensuing spring repairs the damage. Besides, in their long flights to this part of the world, they are famished by the tediousness of their journey, and are therefore more voracious wherever they happen to settle. But it is not by what they devour that they do so much damage as by what they destroy. Their very bite is thought to contaminate the plant, and to prevent its vegetation. To use the expression of the husbandman, they burn whatever they touch ; and leave the marks of their devastation for two or three years ensuing. But if they be noxious while living, they are still more so when dead ; for wherever they fall, they infect the air in such a manner that the smell is insupportable. Orosius tells us, that in the year 3800, there was an incredible number of locusts which infested Africa ; and, after having eaten up every thing that was green, they flew off and were drowned in the African sea ; where they caused such a stench, that the putrifying bodies of hundreds of thousands of men could not equal it.

In the year 1690, a cloud of locusts was seen to enter Russia in three different places ; and from thence to spread themselves over Poland and

and Lithuania, in such astonishing multitudes, that the air was darkened, and the earth covered with their numbers. In some places they were seen lying dead, heaped upon each other four feet deep; in others, they covered the surface like a black cloth: the trees bent beneath their weight; and the damage which the country sustained exceeded computation. In Barbary their numbers are formidable, and their visits are frequent. In the year 1724, Dr Shaw was a witness in that country of their devestation. Their first appearance was about the latter end of March, when the wind had been southerly for some time. In the beginning of April, their numbers were so vastly increased, that in the heat of the day they formed themselves into large swarms, which appeared like clouds, and darkened the sun. In the middle of May they began to disappear, retiring into the plains to deposit their eggs. In the next month, being June, the young brood began to make their appearance, forming many compact bodies of several hundred yards square; and afterwards marching forward, climbed the trees, walls, and houses, eating every thing that was green in their way. The inhabitants, to stop their progress, laid trenches all over their fields and gardens, filling them with water. Some placed large quantities of heath, stubble, and such like combustible matter, in rows, and set them on fire on the approach of the locusts. But all this was to no purpose; for the trenches were quickly filled up, and the fires put out by the vast number of swarms that succeeded each other. A day or two after one of these was in motion, others that were just hatched came to glean after them, gnawing off the young branches and the very bark of the trees. Having lived near a month in this manner, they arrived at their full growth, and threw off their worm-like state, by casting their skins. To prepare themselves for this change, they fixed their hinder feet to some bush or twig, or corner of a stone, when immediately, by an undulating motion used on this occasion, their heads would first appear, and soon after the rest of their bodies. The whole transformation was performed in seven or eight minutes time; after which, they were a little while in a languishing condition; but as soon as the sun and air had hardened their wings, and dried up the moisture that remained after casting off their sloughs, they returned again to their former greediness, with an addition both of strength and agility. But they did not continue long in this state before they were entirely dispersed; after laying their eggs, directing their course northward, and probably perishing in the sea. It is said that the holes these animals make, to deposit their eggs in, are four feet deep in the ground; the eggs are about fourscore in number, of the size of carraway comfits and bundled up together in clusters.

It would be endless to recount all the mischiefs which these famished insects have at different times occasioned; but what can have induced them to take such distant flights, when they come into Europe, is not so easy to be accounted for. It seems most probable, that by means of a very dry season in the heart of Africa, they are propagated in such numbers, that the vegetables of the spot where they are produced are not sufficient to sustain them. Thus being obliged to find out other countries, they traverse the sandy deserts, where they can find no sustenance; still meeting with nothing to allure them from their height, they

they proceed forward across the sea, and thus come into Europe, where they alight upon the first green pastures that occur.

In some parts of the world, the inhabitants turn what seems a plague to their own advantage. Locusts are eaten by the natives in many kingdoms of the east; and are caught in small nets provided for that purpose. They parch them over the fire in an earthen pan; and when their wings and legs are fallen off, they turn reddish, of the colour of boiled shrimps. Dampier has eat them thus prepared, and thinks them a tolerable dish. The natives of Barbary also eat them fried with salt; and they are said to taste like cray-fish.

There is a locust in Tonquin, about the bigness of the top of a man's finger, and as long as the first joint. It breeds in the earth, in low grounds; and in the months of January and February, which is the season for taking them, they issue from the earth in vast swarms. At first they can hardly fly, so that they often fall into the rivers in great numbers: however, the natives in these months watch the rivers, and take them up in multitudes in small nets. They either eat them fresh, broiled on the coals, or pickle them for keeping. They are considered as a great delicacy in that part of the world, as well by the rich as the poor. In the countries where they are eaten, they are regularly brought to market, and sold as larks or quails in Europe. They must have been a common food with the Jews, as Moses, in the book of Leviticus, permits them to eat four different kinds of this animal, which he takes care to specify. This dish, however, has not yet made its way into the kitchens of the luxurious in Europe: and though we may admire the delicacies of the East, we are as yet happily deprived of the power of imitation.

Of all animals, however, of this noxious tribe, the Great West-Indian Locust, individually considered, is the most formidable. It is about the thickness of the barrel of a goose-quill, and the body is divided into nine or ten joints, in the whole about six or seven inches long. It has two small eyes, standing out of the head like those of crabs, and two feelers like long hair. The whole body is studded with small excrescences, which are not much bigger than the points of pins. The shape is roundish, and the body diminishes in circumference to the tail, which is forked into two horns. Between these, there is a sort of a sheath containing a small dangerous sting. If any person happens to touch this insect he is sure to be stung; and is immediately taken with a shivering and trembling all over the body; which, however, may soon be put a stop to, by rubbing the place that was affected with a little palm oil.

Nieuhoff informs us, that in the *East-Indies* there are Grasshoppers and Locusts of several kinds, one of which is as long as a man's finger, but no thicker than a goose quill. The body is distinguished into several joints, and they have six feet, with two small horns or feelers. Other Locusts have brown wings, with a yellow belly, and two feelers, and they can leap a great way. They are likewise seen flying together in great swarms. There is another sort, of the same shape, but green, and of the length of a man's finger; but they come in such prodigious swarms, that they devour every thing that is green in the places where they settle; insomuch that the inhabitants of *Batavia* are often obliged to change their habitations, for want of their usual sustenance.

Le Bruin informs us, on the 9th of October near *Rama* in the *Holy Land*, there was a south-east wind, which blew over the wilderness, and caused a violent heat, that lasted several days. He is of opinion, that it is to this wind, that the prodigious number of Locusts are owing, which flock thither in certain years, and cover the surface of the earth. In the space of two hours, they devoured all the grass and herbs round about *Rama*. There are many birds that feed upon them, and particularly storks. At the time when the locusts engender, they make holes in the earth, about four feet deep, where they lay their eggs, which are about the size of caraway comfits, there being bundles of them together, at least four-score in number. In fifteen or sixteen days time, they become young Locusts, and are all over black, when first hatched; but in twenty-four hours they change, and become green; however it is three weeks before they can use their wings. In many places where these insects die upon the ground, there arises such a stench from their bodies, that it often breeds a dreadful plague.

C H A P. III.

OF FOUR WINGED INSECTS.

Of these there are several sorts, the first of which mentioned by *Linnæus*, is the Cicada, by which *Dale* understands a Bawm Cricket; but he means an insect that has a snout bent downwards, very short feelers, four cruciated wings, feet proper for leaping, a convex back, and a roundish breast.

The *Cuckow-Spit* insect, called by *Swammerdam* the Flea-Locust, and by others the Froth-Worm, has an oblong, obtuse body, and a large head, with small eyes: the external wings are of a dusky brown colour, marked with two white spots, and there is a broad, transverse, double line of the same: the rest of the body is of a dusky brown, and the head is black. It is usually covered over with a frothy matter, resembling spittle, which it does not discharge at the mouth, but at the vent, and at other parts of the body.

The *Cicada* with green wings and a yellow head, is as big as a large fly, but very narrow in proportion to its length: the external wings are of a fine deep green, and the internal of a blueish grey; the covering of the breast is also green, but paler than the wings, and the head is yellow, marked with two large spots on the hinder part, and several small ones at the sides: there are also transverse streaks on the forehead, and the body is of a blueish-grey, with yellow legs. It is commonly seen about water-plants in autumn. *Ray* calls it the third flea Locust.

The *Cicada* with yellow external wings, is about the size of a common fly, is all over of a beautiful yellow, except when the wings are closed, and then a longitudinal black line appears on each side the back, which is so divided in the middle, to form as it were two lines, the one running from the breast, and the other from the tail to the middle, where they are obliquely separated: the two upper parts of these lines join-

join near the breast, and there is on each side, a black spot on the head and breast, but they both unite into one: the feelers are short, the fore-head is a little furrowed transversely, and the body, when the wings are extended, appears to be yellow on the middle, and black on each side. It may be met with in pasture grounds in June.

Linnæus has eight sorts of *Cicadæ*, which he calls the *American Laternaria*, the *Chinese Laternaria*, the *Ranatra*, the *flea Locust*, the *Cicada* with a double homed breast, the *Cicada* bearing manna, the *Cicada* of the elm-tree, and the *Cicada* of the rose.

Other authors have the *Italian* or true *Cicada*, which is an inch long, more than half an inch broad, and of a dusky-brown colour: the smaller *Italian Cicada*: the brown *Cicada*, with wings spotted with paler brown, and with punctated nerves: the black *Cicada* with three equal transverse white lines: the yellow *Cicada* with wings spotted with brown, and marked with four black spots, but yellow on the hinder part: the whitish *Cicada* with a black longitudinal line on each side: the black *Cicada* with white eyes: the black *Cicada* with the edges of the external wings white: the black *Cicada* with a white head: the yellow compressed *Cicada*: the *Cicada* with greenish yellow wings, with the extremities black, and gilded: this is the elm *Cicada* mentioned by Linnæus: the yellow *Cicada* with the extremity of the wings white and membranaceous: the least white *Cicada*.

The proper *Cimex* is generally understood to mean only a common Bug; and Linnæus defines it to be an insect with a snout bending downwards, and feelers that have four joints, four cruciated wings, feet proper for running, a flat back, and a marginated breast.

This is one of those nauseous insects that intrude upon the retreats of mankind; and that often banish that sleep, which even sorrow and anxiety permitted to approach. This, to many men, is, of all other insects, the most troublesome and obnoxious. The night is usually the season when the wretched have rest from their labour; but this seems the only season when the bug issues from its retreats, to make its depredations. By day it lurks like a robber, in the most secret parts of bed; takes the advantage of every chink and cranny, to make a secure lodgment; and contrives its habitation with so much art, that scarce any industry can discover its retreat. It seems to avoid the light with great cunning; and even if candles be kept burning, this formidable insect will not issue from its hiding-place. But when darkness promises security, it then issues from every corner of the bed, drops from the tester, crawls from behind the arras, and travels with great assiduity to the unhappy patient, who vainly wishes for rest and refreshment. It is generally vain to destroy one only, as there are hundreds more to revenge their companion's fate; so that the person who thus is subject to be bitten, remains the whole night like a sentinel upon duty, rather watching the approach of fresh invaders, than inviting the pleasing approaches of sleep.

Nor are these insects less disagreeable from their nauseous stench, than their unceasing appetites. When they begin to crawl, the whole bed is infected with the smell; but if they are accidentally killed, then it is insupportable.

These are a part of the inconveniences that result from the persecution of these odious insects: but happily for Great Britain, they multiply less

in these islands, than in any part of the continent. In France and Italy the beds, particularly in their inns, swarm with them; and every piece of furniture seems to afford them a retreat. They grow larger also with them than with us, and bite with more cruel appetite.

This animal, if examined minutely, appears to consist of three principal parts; the head, the corselet, and the belly. It has two brown eyes, that are very small and a little prominent, besides two feelers, with three joints: underneath these there is a crooked trunk, which is its instrument of torture, and which, when in motion, lies close upon the breast. The breast is a kind of ring, in which are placed the two first pair of legs. The belly consists of nine rings; under which are placed two pair of legs more, making six in all. Each leg has three joints, which form the thigh, the leg, and the foot, which is armed with a crooked claw, like an hook. The body is smooth, except a few short hairs, that may be seen by the microscope, about the vent, and on the two last rings. Its motion is slow and unwieldy; yet its sight is so exquisite, that the instant it perceives the light, it generally makes good its retreat; and they are seldom caught, though the bed swarms with them.

If we examine this insect internally, we shall find the great artery, which in all insects performs the functions of the heart; we shall find the apertures of the lungs on the right side and the left, through which the animal breathes; we shall find a stomach and intestines, which, as in other animals, run from the mouth to the anus. If the insect has been kept long fasting, there will be a mucus found in its body, like the white of an egg; but if crushed after a full meal, the human blood, which it has sucked in, will appear a little darkened by having passed through the insect's body.

The male and female of these animals are plainly distinguishable from each other; and the parts of generation are obvious enough. They are often found coupling tail to tail; and in this state are very easily destroyed. The female has an ovary filled with eggs, joined together like a bunch of grapes; each egg being oblong, almost cylindrical, inclining to white, and pretty transparent. In about two days after impregnation by the male, she deposits her eggs to the number of about an hundred and fifty, in some convenient place where they are likely to receive no disturbance. There they continue for some months; during which time, neither cold nor heat, neither moisture nor fumigation, can in the least retard their exclusion; but they come forth active, and ready for mischief. It is this hardiness in the shell that seems to continue the breed; as the old ones die every winter, or are easily destroyed by any fumigation that is used for that purpose. But the eggs seem incapable of destruction; even those men who make a livelihood by killing these nauseous insects, though they can answer for the parent, can never be sure of the egg. For this reason they usually pay those houses to which they are called a second or a third visit, and at last exterminate them by perseverance.

The manner of destroying them seems rather the effects of assiduity than antidote; for the men called in upon this occasion, take every part of the furniture asunder, brush every part of it with great assiduity, anoint it with a liquid which I take to be a solution of corrosive sublimate,

mate, and having performed this operation twice or thrice, the vermin are most usually destroyed.

Cleanliness, therefore, seems to be the best antidote to remove these nauseous insects; and wherever that is wanting, their increase seems but a just punishment. Indeed, they are sometimes found in such numbers among old furniture, and neglected chambers, exposed to the south, that, wanting other sustenance, they devour each other. They are also enemies to other vermin, and destroy fleas very effectually; so that we seldom have the double persecution of different vermin in the same bed. Of the bug kind Linnaeus reckons up forty.

The *Aphis* or *Plant Louse*, has a bended snout, two horns on the hinder part of the body, four erect wings, and feet proper for walking. Linnaeus has sixteen sorts, namely, that of the Currant-bush; that of the Elm-tree; that of the Elder; that of the Mapple; that of the Lime-tree; that of the Birch; that of the Pine; that of the Rose; that of the Parsnip; that of the Dock; that of the *Carduus Benidictus*; that of Mug-wort; that of Saw-wort; that of Chick-weed; that of the Lily, and that of the Cabbage.

The Currant *Louse* is about the size of a common louse, and of a brownish-green colour: the legs are green, and the joints of the knees commonly stand up above the body and are brown; the feelers are slender, strait, and have a joint, at which they are bent near the head, and are of a black colour: the hinder part of the breast is blackish, and the sides of the body are variegated with small black spots; the wings are erect and whitish, only they have a few black veins, and two of them are very small, but the vent is prominent, and has two bristly appendages shorter than the wings.

This is sufficient to give a specimen of their shape, for as they belong to particular trees and plants, they may be readily seen thereon when the leaves are in perfection: there are doubtless many more than those already mentioned, which belong to particular trees.

The *Coccus*, so called by Linnaeus, has the trunk on its breast, and the body is hairy or downy behind.

The *Coccus* of the berry-bearing *Ilex*, a sort of an oak, is what is known in the druggists shops, by the name of *Kermes*. It appears to be a membranaceous bladder, of the size of a pea, smooth, and shining, and of a brownish red colour, covered with very fine down or ash-coloured powder, swelling with reddish eggs or insects, which being rubbed with the fingers, pour out a crimson liquor. It is only met with in pretty hot countries, in the months of *May* and *June*. In *March* there is first perceived a sort of insect less than a millet-seed, and of an oblong oval form, only a little narrower towards the tail: the upper part is convex, red, and marked with exceeding minute golden specks, and a few transverse wrinkles. It has six feet, and two moveable feelers, which almost equal the length of the body; it has also black eyes, and a double tail of the same length as the body. It adheres to the trunk, branches, and leaves of the tree, and becomes torpid and immoveable, swelling or growing bigger very sensibly. If at that time its body is beheld with a microscope, it appears of a crimson colour, shining with golden specks, and lying in a sort of whitish down, which in some places of the back, under and about the belly, rises up in flocks like a sort of nest: the back rises very high, and is round, and

in the forepart of the body, which is instead of a head, three protuberances are perceived, of which the middle is thickish and roundish, but those on the sides more slender and crooked about the middle.

In the month of *April*, this insect becomes of the size and shape of a pea, and its membrane or skin is firmer, and the down, which at the beginning lay in bands on the skin, covers the whole surface like a sort of powder, and then it seems to be no longer an animal, but a bladder full of pale and watery blood.

About the middle or end of *May*, the inner part of the bladder, under the belly of the animalcula, is furnished with oval grains, about half the size of white poppy seeds, of a pale reddish colour, speckled with gold; they consist of a thin, white, transparent skin, full of a pale reddish liquor: they are about two thousand in number on each bladder, and the eggs of the former insect, which being shaked off, becomes exactly the same as those that run about the branches and leaves of the *Ilex*. In the following spring, they fix themselves in the divisions of the trunk and branches, where they afterwards lay their eggs. When this insect has attained its proper size, the skin of the belly or lower part, is pulled up towards the back, leaving a vacant space between the belly and the down, insomuch that they have the appearance of Hog-lice half rolled up. It is in this space that they lay their eggs, which done the animal dies, and is dried up. They live upon the juice of the leaves, which they suck in with the snouts or trunks.

They are of two sexes, and the females have been hitherto described but the males are very distinct from the former, and are a sort of small flies like gnats, with six feet, of which the four forward are short, and the two backward long, divided into four joints, and armed with three crooked nails: there are two feelers on the head a line and a half long, which are moveable, streaked, and articulated: the tail at the back part of the body is half a line long, and forked: the whole body is covered with two transparent wings, and they leap about in the manner of fleas. The harvest of the *Kermes* is greater or less, in proportion to the severity of the winter; and the women gather them before sunrise, tearing them off with their nails; for fear there should be any loss from the hatching of the insects, they sprinkle them with vinegar, and lay them in the sun to dry, where they acquire a red colour.

There is another sort of *Kermes* mentioned by other authors, which the country people call worms, and which as they affirm, lay whitish eggs, from which proceed insects of the same colour, full of silver specks. It seems to be an insect of the same species as the former, little differing from the red *Kermes*.

There is another blackish *Kermes*, found near *Leghorn* in *Tuscany*, upon the dwarf *Ilex*, like the red kind, only when it comes to maturity, it is full of a whitish liquor, and eggs; from these a sort of insects proceed, not unlike the true *Kermes*, but whitish. Hence it appears there are several kinds of *Kermes*, which only differ in colour; but the red only is used in medicine, and for dying. Doctor *Lijster* has found an insect analogous to this, on the twigs of the cherry, and other trees; for it cannot be said to be the same.

Cochineal, or the grains of the Indian fig, as they appear in our shops, when brought from *America*, are of an irregular shape, convex on one side, and a little concave on the other; but are both marked with transverse

verse streaks or wrinkles : they are of a scarlet colour within, and without of a blackish red, and sometimes of a white reddish ash-colour, which are accounted the best, and they are brought to us from *Mexico*. They have been a long while taken for fruit, but they are now known to be insects adhering to the prickly pear-tree or shrub.

The *Cochineal Insect*, is of an oval form, of the size of a small pea, with six feet, and a snout or trunk, and brings forth its young alive, and is nourished by sucking the juice of the plant. Its body consists of several rings, and when it is once fixed on the plant, it continues immoveable, being subject to no change. Some pretend there are two sorts, the one domestic, which is best, and the other wild, that is of a vivid colour, however they appear to be the same, only with this difference ; that the wild feed upon cultivated trees, without any assistance ; whereas the domestic are carefully at a stated season, removed to cultivated trees, where they feed upon a purer juice. Those who take care of these insects, place them on the prickly pear-plant, in a certain order, and are very industrious in defending them from other insects ; for if any other kind come among them, they take care to brush them off with foxes tails.

Towards the end of the year, when the rains and cold weather are coming on, which are fatal to these insects, they take off the leaves or branches covered with cochineal, that have not attained their utmost degree of perfection, and keep them in their houses till the winter is past. These leaves are very thick and juicy, and supply them with sufficient nourishment, while they remain within doors. When the milder weather returns, and these animals are about to exclude their young, the natives make them nests, like those of birds, but less, of tree-moss, or soft hay, or the down of cocoa-nuts, placing twelve in every nest. These they fix on the thorns of the prickly pear-plant, and in three or four days time, they bring forth their young, which leave their nests in a few days, and creep upon the branches of the plant, till they find a proper place to rest in taking their nourishment ; and when the females are fecundated by the males, they produce a new offspring ; so that they have a harvest, as it were thrice a year.

When the native *Americans* have gathered the cochineal, they put them into holes in the ground, where they kill them with boiling water, and afterwards dry them in the sun, or in an oven, or lay them upon hot plates. From the various methods of killing them, arise the different colours which they appear in when brought to us. While they are living, they seem to be sprinkled over with a white powder, which they lose as soon as the boiling water is poured upon them. Those that are dried upon hot places, are the blackest. What we call cochineal, are only the females ; for the males are a sort of fly, as in the Kermes. They are used both for dying, and in medicine, and are said to have much the same virtue as the Kermes ; though they are now seldom used alone, but are mixed with other things, for the sake of the colour.

The *Polish Scarlet Grain*, is, when full grown, of the size of a small pepper-corn, and is of a roundish shape, there being but little sign of an animal. It sticks to the root of the tree on which it feeds, and is of a deep purple colour, tinged with blue. It lies in a rough cup, somewhat resembling that of an acorn, when they are gathered for use.

They

They seem to be excrescences upon the root where they produce their young, which at first are evidently real insects, having small, and somewhat longish flattish bodies, which consist of several segments; and they have six legs, which are short and slender, and two fine feelers: they are also of a purple colour, but not so deep as that of the parent. When these are grown to their full size, they fix themselves to the root of the plant, and appear as above described: the young ones are bred in the case or skins of the old ones, after they are dead: the male is a fly with two wings, as in the kinds already mentioned.

The *Polyb Cochineal* is a sort of Kermes found at the roots of the tree called Polonian knawel, which are full of a purple juice, and worms of the same colour: this plant is very common in the *Ukrain*, especially in the most desert places. The *Armenians* and the *Turks* dye the wool, silk, and hair therewith, as well as the manes and tails of their horses.

These insects are placed by *Linnæus* in the number of those with half wings, that have the mouth placed in the breast, and the belly hairy below; however it is only the male that has wings.

The *Gall Insects* are bred in a sort of bodies, adhering to a kind of oak in *Asia*, which differ with regard to their colour, size, roughness, smoothness, and shape, and which we call galls: they are not fruit as some have imagined, but preternatural tumors, owing to the wounds given to the buds, leaves, and twigs of the tree, by a kind of insects wherein they breed and lay their eggs. When the Galls are ripe and opened while fresh, a sort of worms are found therein, sometimes one, and sometimes more, near the center in cells, which after some time turn to flies: they make themselves a passage out, by eating the substance of the gall, and making a round hole therein, they get abroad and fly away. However we do not meet with any author that has given a minute description of them.

The green stove *Bug* is a small insect of an oval flat shape, which firmly adheres to the bark or leaves of trees: the back is a little prominent, and its belly hollowed; and the forepart is blunt, but that behind forked. It appears in a kind of shell or covering, which incloses the body of the insect; it has six very slender legs, and the eyes small and black, and the feelers very slender. It is of a greenish colour, and can thrust out its legs at pleasure, sometimes moving about though slowly; however it generally adheres to the leaf of the tree, continuing in the same place, and sucking out the juice. The male is a small fly, and not nearly so big as the female, having a slender oblong body, and long legs: the feelers are short, and the wings white. The female is common here in *England*, on the orange and lemon trees preserved in stoves in green-houses; and is probably the same which *Linnæus* calls the *Coccus* of the citron tree, or the shielded Louse.

The water *Coccus* has a body of an oval figure, rounded on the back, and flat on the belly; and its colour is brown. It thrusts out a sort of white hairy beard from its hinder part, which is cloven in two, and near it there is placed a blunt tubercle, and towards the other extremity another that is blunt. It is common on the leaves of water-plants, and shews its legs but very seldom, which are slender, and somewhat downy. The male is a small fly, with silky whitish wings, spotted with brown.

The *Coccus* of the birch tree, is larger than the former, and has an oblong body, somewhat downy, which is composed of several rings or joints. It is of a deep dusky olive colour, with short legs, and very slender feelers. It is common on several trees in woods, where it fixes to the division of the branches. The male is a little fly with dusky brown wings.

The *Coccus* of insects is very small, and is found on the bodies of the larger kind of Beetles, where it is fixed almost during its whole life: the body is of an oval shape, with a sharp edge; and is somewhat convex, and of a reddish brown colour: the surface of the whole body is smooth, but not glossy, and the legs are very short, as well as the feelers, which are scarce visible.

Besides these *Linnaeus* has the *Coccus* of the common Mouse-ear; that of Canary-grass; and that of the Birch tree; and there are probably other kinds not yet discovered.

The *Thrips*, so called by *Linnaeus*, has little or no snout, and the body is of a linear shape, with four strait wings lying on the back.

The *Thrips* with blueish wings and a black body, is not so big as a flea, and its wings must consequently be small and delicate: it has six legs, two near the neck, and four on the breast; the feelers are slender, black, and consist of six joints, the external wings are of a greyish colour, and hairy at the extremities, and at the edges. It flies very seldom, but runs very swiftly, twisting its body into various shapes.

The black bodied *Thrips*, is about the size of a Louse, and has an oblong slender body: the external wings are very beautiful, variegated with nine alternate transverse streaks of black and white, there being three of each colour: it is found on the flowers of the larger hawk-weeds, and runs very swift, but seldom flies.

The *Thrips* with a brown body, and snow white wings, is of the same size as the former: its brown appearance is owing to the wings, for the colour of the body is coal black: the legs are short, and the feelers very slender, consisting of five joints: it is sometimes found on the *Bermudas* cedars, which are planted in our gardens.

C H A P. IV.

OF INSECTS WITH MEMBRANACEOUS WINGS, WHICH ARE FOUR IN NUMBER, AND RETICULATED WITH VEINS.

THE *Panorpa*, so called by *Linnaeus*, is the Scorpion Flie: that taken notice of by *Moufet*, is about the size of a common fly, and of the colour of honey, only the top joint of the tail is black, and armed with a double sting: the wings are like those of the Grasshopper, and its walk is like that of a crab: that which other authors call a Scorpion Flie, has an oblong roundish body, and a small head, and a hard horny oblong snout, bending downwards: the feelers are bristly, black, and consist of thirty joints: the back is brown, the sides yellow, and the wings white, with some dusky spots disposed in transverse rows,

forming a sort of line: the tail is articulated, and is terminated by a weapon resembling that of a Scorpion: this is doubtless the same insect with that of *Mouset*. *Linnaeus* says that it has a horny cylindric snout, and a shelly tail.

The *Raphidia* or sharp-tailed Flie, has a horney flattish head, and a bristly sharp tail, and is of the same size as the Scorpion Flie, pretty much resembling it in shape: the head is black, smooth, and narrow on the hinder part, and the breast is narrow, rounded, and black: the feelers are slender, white, and consist of a great number of joints; the body is slender, oblong, and of a brown colour, variegated with transverse white lines: the wings are thin and membranaceous, being reticulated, and having each an oblong brown spot towards the edge. From the hinder part of the body of the female, there grows a long, sharp, slender, and bended weapon. It is common in the meadows near the waters, in *July*.

The *Chrysops* or *Golden-Eye*, by some called the Stinking Flie, is a very beautiful insect, and is about three quarters of an inch in length: its body is very slender, and of a greenish yellow colour; the wings are very large and transparent, except the larger ribs or fibres that are of a fine green, which are pretty numerous: the eyes are very large, and have the appearance of gold; but when this insect is crushed, it sends forth an intolerable stench, for which reason it is called the stinking flie. It is produced from a worm that feeds upon the plant-lice, upon which account it is named the plant-louse Lion.

The *Formica Leo*, or *Ant Lion*, is of the length of the common hog-louse, but somewhat broader; and it has a pretty long head, and a roundish body, which becomes a little narrower towards the tail: the colour is a dirty grey, speckled with black, and the body is composed of several flat rings, which slip one upon another: there are six feet, four of which are fixed to the breast, and two to the neck: the head is small and flat, and before there are two little smooth horns or feelers, which are hard, two lines in length, and crooked at the ends. At the bases of the feelers, there are two small black lively eyes, by which it can see the smallest object. Other animals have wings or feet, which enable them to advance towards their prey, but this can only run backwards, for it would sooner die than take the least step towards it; for which reason the prey most come to it, or rather into the snare provided for it; which is the only means this insect has to live.

It chuses a dry and sandy place, at the foot of a wall, or under some shelter, in order to preserve its work from the rain: the driest sand is the most proper for it, because any other would defeat its labour. When it goes about to dig the hole where it takes its prey, it begins to bend its hinder part, which is pointed, and begins to work upon the sand backwards, making after several attempts, a circular furrow, whose diameter is always equal to the depth of the hole or pit. On the edge of this first furrow it digs a second, then a third, and afterwards others which are always less than those preceding; then it begins to sink deeper and deeper into the sand: which it throws with its horns or feelers towards the edges, and farther marching always backwards in a spiral line, in proportion as it sinks into the sand: the repeated motions of its head, throw the sand out of the circle, till the pit is quite made. It always describes a perfect circle, and traces a spiral

spiral line without compasses ; and the pit itself resembles the inside of a funnel turned upside down.

When this insect is newly hatched, the first pit it makes is very small ; but as it grows bigger, it makes them larger, one of which is about two inches and upwards in diameter, and about as much deep : the work being finished, it places itself in ambuscade, hiding itself at the bottom under the sand, in such a manner, that its two horns exactly embrace the point, which is the bottom and middle of the pit. It then waits for its prey ; and if by misfortune, a hog louse, an ant, or other insect, begins to walk round the edge of the precipice, which is made shelving on purpose to make them fall into the trap, which they generally do, the *Ant-Lion* never fails to seize upon them. When the fall of a few grains of sand gives notice of the approach of its prey, it begins to shake the bottom of the sand, which never fails to fall down together with the prey. But if the prey is so nimble, as to run or fly away speedily, it shoots up the sand, which falls down again like hail upon it, and it being blinded and overwhelmed therewith, it is dragged by the motion of the sand to the center of the hole, where it falls between the two feelers or nippers of the enemy, and is soon buried in the sand, where the *Ant-Lion* feeds upon it. When there remains nothing but the shell of the body, this insect takes it up with its feelers, and throws it at least six inches from the edge of the pit ; and then it goes to work again to repair the damage that has been done. It is wonderful to consider that this insect will wait patiently for its prey, sometimes a week, or even a month, without stirring from its place, and consequently without eating. Some of these that have been kept in a box with sand, have lived six months and upwards, without feeding at all. However it must be owned, that those that feed, become much larger, and more strong.

When the *Ant-Lion* attains a certain age, in which it is to change into another form, then it leaves off making pits ; but it continues to make furrows in the land, though in an irregular manner, probably with a design to put itself in a sweat ; after which it hides itself under the sand. Either the sweat, or a gummy liquor that proceeds from the body, unites the grains of sand, which form a sort of crust all over it, and then it appears like a ball, half an inch in diameter ; but so as to leave room enough for the insect to move, but it must be observed, that the gummy liquor also condenses into a thread, finer than those of the silk-worm, which it first fixes to one place, then to another, crossing and recrossing it in such a manner, as to line the inside of its retreat with a fine silky stuff work, of a pearl colour, extremely delicate, and perfectly beautiful. But though the work is so curious and commodious on the inside, without it appears to be nothing but sand, in so much that it cannot easily be distinguished from that which lies next it, and so it escapes the search of birds, that might otherwise prey upon it.

This insect continues thus shut up for six weeks, or two months, and gradually parts with its eyes, its feelers, its feet, and its skin ; and all the flough falls to the bottom of the ball like a rag : then there remains a Nymph, which has other legs, other feet, and other entrails ; as also wings which are wrapped up in a skin, which seems to be nothing else but a liquor dried on its outside, in the same manner as it happens to all sorts of Butterflies. When the members of this new in-

fect have acquired the necessary consistence and vigour, it tears its lodging, and breaks through its wall. For this purpose it has two teeth, like those of Grasshoppers, with which it eats through, and enlarges the opening, till it gets quite out. Its body which is turned like a screw, takes up no more than the space of a quarter of an inch; but when it is unfolded, it becomes half an inch in length; then its fore wings likewise unfold, and in two minutes time, become longer than the body. In short it becomes a large and beautiful Fly, laying aside its barbarity, and rapacious disposition: it has then a long slender body, of a brown colour, a small head, with large bright eyes, and long, slender, pale brown legs, with four large reticulated wings: it greatly resembles the Golden Eye in all things, except its colour, which is not quite so agreeable: it is common in most parts of *Europe*: there are other insects akin to this, which only differ in their size and colour; but the progress of their metamorphosis has not been described.

The *Summer Fly* has a prominent palate, with two feelers on each side, which are twice as long as the body, and blueish-black wings: the body is oblong, and of a dusky brown; but his legs, which are slender, are of a dusky greyish black. While it is a worm, it may be frequently seen at the bottoms of small clear brooks, hid in a cage of straw: and when it turns to a fly, it comes out of the water, and roves over or about the same streams: that mentioned by *Moufet*, has four wings, of a brown colour, an oblong body, and two short feelers, with a forked tail, or rather with two bristles proceeding from it. However there are a great many others of this kind, which leave sufficient room for curious enquirers to enlarge the history of these insects.

Linnaeus takes notice of several kinds of the Water Flies, and he calls the first, the black *Phryganea* with white wings, streaked and speckled with white: this fly has four wings, and is of the size of the Scorpion Fly; the wings are longer than the body, white, pointed, and streaked with brown veins. It is found in dirty splashy paths.

2. The *Phryganea* or *Water Fly*, with testaceous wings, and nervous streaks; the feelers are placed forwards. It is found in the same places as the former.

3. The grey *Phryganea* with the upper wings clouded, and marked with a black spot in the margin. It is of a middle size, and is found in waters.

4. The *Phryganea* with ash-coloured testaceous wings, and two longitudinal black lines, with a white point.

5. The *Phryganea* with deflexed flat wings of a yellowish-colour, and marked on the edge with a rhomboidal white spot.

6. The *Phryganea* with dusky wings, and a double yellow spot on the edges.

7. The *Phryganea* with reticulated wings, without a weapon in the tail, and yellow edges on the breast: this keeps very still upon the waters.

8. The *Phryganea* with wings reticulated with veins, and a brown tail. It is called in the *Upsal* transactions, the *Summer Fly*, with a tail that has two hairs, and ash coloured wings reticulated with veins. It is a large water Fly, which appears in summer..

9. The *Phryganea* with blueish-black wings, and feelers twice as long as the body. It is called by *Ray* a small four winged fly, with very long feelers.

feelers, in proportion to the body. It is found fluttering among the reeds, and in cloudy weather great swarms of them may be seen in the air.

10. The *Phryganea* with cloudy upper wings, and feelers three times as long as the body.

11. The leaping *Phryganea* with feelers as long as the body, and the wings marked with a green and white spot.

12. The black *Phryganea* with incumbent cloudy ash-coloured wings, and three blunt hairs at the tail. It may be met with every where in the beginning of the spring.

13. The dusky *Phryganea* without spots, is found at *Fablon* in *Sweden*.

The *Ephemera* is a Flie so called, because it has been said to live but a day, which is in some sense true; though there are a sort that never enjoy the benefit of the sun at all; for they do not come into the world till after the sun is set, and die before its rising: they are in general very pretty flies, and might be ranked among Butterflies, on account of their shape and their wings: these last are shorter and broader in proportion, than those of the common flies, and have a large base; but they differ from those of Butterflies, in not being covered with the dust that renders them opaque; for they are very transparent, and very thin: they have four wings, the uppermost of which are much the largest. When this insect is at rest, it generally lays its wings one over the other on the back; and the body is long, being formed of six rings that are larger at the origin than near the extremity, and from this a tail proceeds, that is longer than all the rest of the flie, and consists sometimes of three threads of an equal length, and sometimes of two long threads, and one short.

All *Ephemeras* were at first worms, and then *Aurelias*; and under these forms they grow very slowly in the water; for *Swammerdam* thinks that some of this kind continue three years under the water. Mr *Reaumur* has known them that have been two years there, and many that have been one. But when the flies that proceed from these worms, come to be inhabitants of the air, they all die almost immediately, though Mr *Reaumur* asserts, that some flies of this name live for several Days.

The insect that is to become the flie called *Ephemera*, has six scaly legs, fixed on the corset, which in some of these kinds is double, or as it were, divided into two parts: the head is triangular, and a little flattened above and below; the eyes, which are placed before, may be distinguished by their largeness and colour: they are brown in most of these insects, and near the base of each, there is a feeler on the inner side; the mouth is furnished with teeth, and the body consists of six rings; that next the corset is the largest, and they grow less and less to the end; and the last ring is the shortest, from which the three threads proceed, which are as long as the whole body.

These insects live in different places, for some have fixed habitations, and some wander about: those that have fixed habitations, lye in holes on the surface of the earth, under the water of rivers and slow streams. One of these seldom leaves its hole, unless through necessity, and then it makes another: those that wander about, sometimes swim, and sometimes creep on bodies that are under the water; sometimes they hide themselves among the rushes, or under pieces of wood, and at other times become quiet and still on the same bodies.

Among those that do not change their place, there are a sort of tufts on each side, which some have taken for fins ; but Mr *Reaumur* found by the help of a microscope, that they are the gills of this insect, which he affirms to be a real fish : the number of the gills is not the same in different kinds, for *Swammerdam* tells us, there are six on each side, and *Reaumur* seven.

While these insects continue in the state of worms, they are of a flesh-colour, and the *Aurelias*, when they have been just transformed, are the same ; but when they are ready to become flies, they turn to a pretty strong yellow, and the corset is brown : the *Ephemeras* of *Holland* appear about *St John's* day, when clouds of them may be seen ; whereas they do not appear about *Paris* till the middle of *August*. Some make their appearance about six o'clock, that is about two hours before sun-set, while others are not seen till the sun is just ready to disappear.

Though the lives of these flies are so short, they have sufficient time to perform the end of their production ; for they are no sooner metamorphosed into flies but they begin to lay their eggs, which some do in rivers, and others on any substance that they meet with ; and they are said to lay more at a time than any other insect whatever ; for each bunch of eggs is said to consist of three hundred and fifty, and there are generally two bunches.

There are several sorts of flies, belonging to this class, that live several days, as was before observed ; one kind of which are in a condition different from all other flies, for they have still another case or skin to get rid of : these are to be seen in the fields, and in woods distant from any water ; but it is more common to find them among those that are nearest. Some of these may be seen sticking upon walls and trees, and often with the head downwards, without changing place, or having any sensible motion ; for they wait for the moment when they shall be divested of their last incommodious garment ; but sometimes this does not happen till twenty-four hours are expired.

Linnaeus places them among flies that have nervous wings, and takes notice of six different sorts. The first kind of *Ephemera* has wings spotted with brown, the tail consisting of three threads ; and this is found near lakes.

2. The second has white wings that are streaked, and has a forked tail. It is called in the transactions of *Upsal*, the *Ephemera* with wings of a whitish flesh-colour : they are seen fluttering in swarms by the sides of waters.

3. The *Ephemera* with white streaked wings, may be distinguished from all others of this kind, by that mark only.

4. The brown *Ephemera* with a tail consisting of two threads, with white wings.

5. The *Ephemera* with white wings, having a thick blackish edge, and a tail consisting of two threads. It is called in the *Upsal* transactions, the least *Ephemera* with white wings.

6. The black *Ephemera* with white lower wings.

The *Ephemera* with white reticulated wings, and two hairs at the tail, is a pretty large fly, with an oblong slender whitish body, except towards the tail, where it is brown : the head is small, and on its top there are two prominences, which have the appearance of eyes, but are

are really placed above them: the breast is compressed, and the two hairs of the tail are twice as long as the body; and between them there are two short crooked ones; the legs are white as snow, but those before are longer than the rest. It is commonly seen flying over waters in the summer months.

The *Ephemera* with streaked wings, is a small fly, with an oblong slender brownish body, and a blunt tail without hairs: the wings are large, white, and streaked, and so formed, as to appear like net-work: there are two prominent tubercles on the head that are smaller than the eyes, and the male has a black breast, and a transparent body; but that of the female is of a reddish brown.

The brown *Ephemera* is about the size of a Gnat, and has an oblong slender body, and of a dusky brown, with a black breast, and long and slender legs: the wings are large and transparent, and somewhat of a whitish colour; and the tubercles above the eyes are very large, being of a deep blueish black; there are also two hairs at the tail, which are as long as the body.

The *Libellula*, so called by *Linnaeus*, is a sort of water fly, for which reason they are called water Nymphs by the *Germans*, and sometimes Dragon Flies.

The blueish green bodied *Libellula* is a beautiful insect, and has a body almost an inch in length, which is of a fine green, with a blueish cast: the head is large, as well as the eyes, which are prominent; and the legs are slender and black: the wings are brownish, with a yellowish tincture, and have each an oblong white spot near the edge: the male has a blue body, and blueish wings, and is commonly seen flying over waters.

The red bodied *Libellula* has a body nearly as long as the former; but it is more slender, and of a bright red colour, with a large head, and large prominent eyes: the legs are slender, and there are some black lines near the segments of the belly; but the wings are pellucid and brownish, and have each a brown spot near the edge. It is common about fish-ponds.

The *Libellula* with a double spot on the edge of each wing, is near an inch and a half long, and considerably thick; but it is larger at the two extremities than in the middle: the breast is thick, of a greyish colour, and hairy on the upper part; the wings are yellowish towards the base, and whitish elsewhere, except the double spots, which are of a dusky brown: the body itself is of a shining green, and a little hairy on the sides, and the tail has two appendages. It is common about rivers.

Linnaeus likewise divides these insects into the middle sized, the small, and the great.

1. The first of the middle sized is called by the author the *Libellula* with a silky shining body, and wings of a yellowish dusky colour. It is termed by *Ray* the middle sized *Libella* with a blueish green body, and dun wings without spots. It frequents the sides of rivers, and the colour is blue, inclining a little to black; the wings are of a yellowish brown, without any speck on the external edges of the wings, which all other kinds are marked with, except the two following.

2. The *Libellula* with a blue shining body, and wings of a blueish-green, dusky at the point, and without spots on the edge. It is called by

by *Ray* the middle sized *Libella*, with a blue body, and the greatest part of the wings of a blackish blue. This likewise frequents rivers, and is of the size and shape of the former, but the wings are of a blackish blue, with the points of a pale brown, and the tail horny at the end.

3. The *Libellula* with a greenish-blue body, dusky wings, and a white spot upon the edge. It is termed by *Ray* the middle sized *Libella*, with a green body, and wings of a dunnish colour, marked with small spots, that are white near the extreme angle: the body is of a green shining colour, with black feet and brown wings, which are marked on the edges with an oblong white spot. Some think it is the female of the former.

4. The *Libellula* with a silky shining body, and the wings of a dusky gold colour, marked with a black spot. It is termed by *Ray* the middle sized *Libella*, with a body partly green, and partly blue, and the wings marked in the middle with very large blueish black spots: the body is of a bright blue, the feet black, and half the wings next the point, of a blueish-black, with points of a gilt brown; the other half of the wings near the base, are of a gold colour.

Of the *Libellula* of the last kind are,

1. That with a silky body, and the wings marked on the edge with a dusky spot. It is called by *Ray* the lesser *Libella* with reticulated wings, a green back, and whitish furrows: this fly flutters on the sides of marshes, and has a back of the colour of copper, with gilded shining wings, marked on the edge with a rhomboidal brown speck: the wings are composed of two nerves, which are particular to this insect; and the breast, belly and sides, are of a livid colour; the eyes are of an ash-colour, but brown above, and the head, as far as the back, is of the colour of copper: the feelers are black, short, and thick at the last joint.

2. The *Libellula* with a flesh-coloured body, and wings with a dusky spot on the edges. It is termed by *Ray* the middle sized *Libella*, with two black spots near the incisures: it is very like the former, both in size and shape; but near the furrows of the belly there are black lines or characters, and a brown spot on the edge of the wings.

3. The *Libellula* with a silky body, and the edge of the wings marked with a black spot, is named by *Ray* the *Libella* with a blueish livid body: it has white wings, and the upper part of the body is of a greenish shining blue, without mixture.

4. The *Libellula* with a blue body variegated with ash-colour, and a black spot on the edges of the wings; *Ray* terms it the lesser *Libella* with short wings, and a blue body, marked with transverse black spots. It is of the same size and shape as the three former, and the wings are white; the joints of the belly, viewed before, are of an ash colour, and behind of a shining blue.

Of the large kind of *Libellula*, there are,

1. That with a double spot on the edges of the wings, called by *Ray* the greatest *Libella*, with a long, shining, slender, smooth, greenish belly, at the beginning, and swelling near the end. It is distinguished from the rest, by having two spots on the wings, that are white, but yellow towards the base, and black underneath the yellow colour.

2. The *Libellula* with white wings, but yellow at the base; it is named by *Ray* the greatest *Libella*, with a broad, short, yellow belly. It

It is yellow on the back, but black underneath ; and on each side there are two oblique yellow lines : the forehead is green, the eyes grey, the feet black, and the wings of a rusty colour at the base.

3. The *Libellula* with a dusky body, and white wings, is called by *Ray* the greatest *Libella* with a yellow narrow body, and no dusky spots at the root of the wings : the body is black, the wings white, with a reddish brown speck on the edges, and the vent without any appendage.

4. The *Libellula* with yellow sides and white wings, is commonly seen on waters, and the sides of the breast and belly are of a yellow colour ; the specks on the edges of the wings are of a brown rusty colour.

5. The *Libellula* with a green shining breast, yellow lines, pale wings, and a black belly. It is termed by *Ray* the great *Libella* with a short blue belly : the head and breast are of a shining green, the eyes brown, and there are two yellow lines on the sides of the breast ; but the wings are whitish yellow at the base, and the marginal spot is brown.

6. The *Libellula* of a gilded green, with pale wings and black feet, is like the former, only it differs from it in the male, which has a dentated tail, and in the female, whose tail consists of leaves, in the shape of a lance.

7. The grey *Libellula* with yellowish wings, and the sides of the breast marked with yellow lines, with a tail consisting of two leaves, it is called by *Ray* the great *Libellula* with a long slender belly, and yellowish wings.

8. The *Libellula* with the breast of a yellowish green, with black lines, and a blackish belly, with yellow marks.

C H A P. V.

OF MEALY WINGED INSECTS, WITH A SPIRAL MOUTH.

IF we take a cursory view of insects in general, *Caterpillars* alone, and the *Butterflies* and *Moths* they give birth to, will make a third part of the number. Wherever we move, wherever we turn, these insects, in one shape or another, present themselves to our view. Some, in every state, offer the most entertaining spectacle ; others are beautiful only in their winged form. Many persons, have an invincible aversion to caterpillars, and worms of every species : there is something disagreeable in their slow crawling motion, for which the variety of their colouring can never compensate. But others feel no repugnance at observing, and even handling them with the most attentive application.

There is nothing in the butterfly state so beautiful or splendid as these insects. They serve, not less than the birds themselves, to banish solitude from our walks, and to fill up our idle intervals with the most pleasing speculations. The butterfly makes one of the principal ornaments of oriental poetry ; but, in those countries, the insect is larger and more beautiful than with us.

The beauties of the fly may therefore very well excite our curiosity to examine the reptile. But we are still more strongly attached to this

tribe, from the usefulness of one of the number. The silk worm is, perhaps, the most serviceable of all other animals; since, from its labours, and the manufacture attending it, near a third part of the world are clothed, adorned, and supported.

Caterpillars may be easily distinguished from worms or maggots, by the number of their feet; and by their producing butterflies or moths. When the sun calls up vegetation, and vivifies the various eggs of insects, the caterpillars are the first that are seen, upon almost every vegetable and tree, eating its leaves, and preparing for a state of greater perfection. They have feet both before and behind; which not only enable them to move forward by a sort of steps made by their fore and hinder parts, but also to climb up vegetables, and to stretch themselves out from the boughs and stalks, to reach their food, at a distance. All of this class have from eight feet at the least, to sixteen; and this may serve to distinguish them from the worm tribe, that never have so many. The animal into which they are converted, is always a butterfly or a moth; and these are always distinguished from other flies, by having their wings covered over with a painted dust, which gives them such various beauty. The wings of flies are transparent, as we see in the common flesh fly; while those of beetles are hard, like horn: from such the wing of a butterfly may be easily distinguished; and words would obscure their differences.

From hence it appears, that caterpillars, whether in the reptile state, or advanced to their last state of perfection into butterflies, may easily be distinguished from all other insects; being animals peculiarly formed, and also of a peculiar nature. The transmutations they undergo, are also more numerous than those of any insect hitherto mentioned; and, in consequence, they have been placed in the third order of changes by Swammerdam, who has thrown such lights upon this part of natural history. In the second order of changes, mentioned before, we saw the grasshopper and the earwig, when excluded from the egg, assume a form very like that which they were after to preserve; and seemed arrived at a state of perfection, in all respects, except in not having wings; which did not bud forth until they were come to maturity. But the insects of this third order, that we are now about to describe, go through a much greater variety of transformations: for, when they are excluded from the egg, they assume the form of a small caterpillar, which feeds and grows larger every day, often changing its skin, but still preserving its form. When the animal has come to a certain magnitude in this state, it discontinues eating, makes itself a covering or husk, in which it remains wrapped up, seemingly without life or motion; and after having for some time continued in this state, it once more bursts its confinement, and comes forth a butterfly. Thus we see this animal put on no less than three different appearances, from the time it is first excluded from the egg. It appears a crawling caterpillar; then an insensible aurelia, as it is called, without life or motion; and lastly, a butterfly, variously painted, according to its different kind. Having thus distinguished this class of insects from all others, we will first survey their history in general; and then enter particularly into the manners and nature of a few of them, which most deserve our curiosity and attention.

When winter has disrobed the trees of their leaves, Nature then seems to have lost her insects. There are thousands of different kinds, with and without wings, which, though swarming at other seasons, then entirely disappear. Our fields are re-peopled, when the leaves begin to bud, by the genial influence of spring; and caterpillars, of various sorts, are seen feeding upon the promise of the year, even before the leaves are completely unfolded. Those caterpillars, which we then see, may serve to give us a view of the general means which Nature employs to preserve such a number of insects during that season, when they can no longer find subsistence. It is known, by united experience, that all these animals are hatched from the eggs of butterflies; and those who observe them more closely, will find the fly very careful in depositing its eggs in those places where they are likely to be hatched with the greatest safety and success. During winter, therefore, the greatest number of caterpillars are in an egg state; and in this lifeless situation, brave all the rigours and the humidity of the climate; and though often exposed to all its changes, still preserve the latent principles of life, which is more fully exerted at the approach of spring. That same power that pushes forth the budding leaf, and the opening flower, impels the insect into animation; and Nature at once seems to furnish the guest and the banquet. When the insect has found force to break its shell, it always finds its favourite aliment provided in abundance before it.

But all caterpillars are not sent off from the egg in the beginning of spring; for many of them have subsisted during the winter in their *aurelia* state: in which, as we have briefly observed above, the animal is seemingly deprived of life and motion. In this state of insensibility, many of these insects continue during the rigours of winter; some enclosed in a kind of shell, which they have spun for themselves at the end of autumn; some concealed under the bark of trees; others in the chinks of old walls; and many buried under ground. From all these, a variety of butterflies are seen to issue, in the beginning of spring; and adorn the earliest part of the year with their painted flutterings.

Some caterpillars do not make any change whatsoever at the approach of winter; but continue to live in their reptile state, through all the severity of the season. These chuse themselves some retreat, where they may remain undisturbed for months together; and there they continue quite motionless, and as insensible as if they were actually dead. Their constitution is such, that food, at that time, would be useless; and the cold prevents their making those dissipations which require restoration. In general, caterpillars of this kind are found in great numbers together, enclosed in one common web, that covers them all, and serves to protect them from the injuries of the air.

Lastly, there are some of the caterpillar kind, whose butterflies live all the winter; and who, having fluttered about for some part of the latter end of autumn, seek for some retreat during the winter, in order to answer the ends of propagation, at the approach of spring. These are often found lifeless and motionless in the hollows of trees, or the clefts of timber; but, by being approached to the fire, they recover life and activity, and seem to anticipate the desires of spring.

In general, however, whether the animal has subsisted in an egg state, during the winter; or whether as a butterfly, bred from an *aurelia*,

reli, in the beginning of spring ; or a butterfly that has subsisted during the winter, and lays eggs as soon as the leaves of plants are shot forward, the whole swarms of caterpillars are in motion to share the banquet that Nature has provided. There is scarce a plant that has not its own peculiar insects ; and some are known to support several of different kinds. Of these, many are hatched from the egg, at the foot of the tree, and climb up to its leaves for subsistence : the eggs of others, have been glued by the parent butterfly to the leaves ; and they are no sooner excluded from the shell, but they find themselves in the midst of plenty.

When the caterpillar first bursts from the egg, it is small and feeble ; its appetites are in proportion to its size, and it seems to make no great consumption ; but as it increases in magnitude, it improves in its appetites ; so that, in its adult caterpillar state, it is the most ravenous of all animals whatsoever. A single caterpillar will eat double its own weight of leaves in a day, and yet seems no way disordered by the meal.—What would mankind do, if their oxen or their horses were so voracious !

These voracious habits, with its slow crawling motion, but still more a flinging like that of nettles, which follows upon handling the greatest number of them, make these insects not the most agreeable objects of human curiosity. However, there are many philosophers who have spent years in their contemplation ; and who have not only attended to their habits and labours, but minutely examined their structure and internal conformation.

The body of the caterpillar, when anatomically considered, is found composed of rings, whose circumference is pretty near circular or oval. They are generally twelve in number, and are membranous ; by which caterpillars may be distinguished from many other insects, that nearly resemble them in form. The head of the caterpillar is connected to the first ring by the neck ; that is generally so short and contracted, that it is scarce visible. All the covering of the head in caterpillars seems to consist of a shell ; and they have neither upper nor under jaw, for they are both placed rather vertically, and each jaw armed with a large thick tooth, which is singly equal to numbers. With these the animals devour their food in such amazing quantities ; and with these, some of the kind defend themselves against their enemies. Though the mouth be kept shut, the teeth are always uncovered ; and while the insect is in health, they are seldom without employment. Whatever the caterpillar devours, these teeth serve to chop it into small pieces, and render the parts of the leaf fit for swallowing. Many kinds, while they are yet young, eat not only the succulent part of the leaf, and leave all the fibres untouched ; others, however, attack the whole leaf, and eat it clean away. One may be amused, for a little time, in observing the avidity with which they are seen to feed ; some are seen eating the whole day ; others have their hours of repast ; some chuse the night others the day. When the caterpillar attacks a leaf, it places its body in such a manner that the edge of the leaf shall fall between its feet, which keeps it steady, while the teeth are employed in cutting it : these fall upon the leaf, somewhat in the manner of a pair of garden-
er's sheers ; and every morsel is swallowed as soon as cut. Some caterpillars

terpillars feed upon leaves so very narrow, that they are not broader than their mouths; in this case the animal is seen to devour it from the point, as we would eat a radish.

As there are various kinds of caterpillars, the number of their feet are various; some having eight, and some sixteen. Of these feet the six foremost are covered with a sort of shining gristle; and are therefore called the shelly legs. The hindmost feet, whatever be their number, are soft and flexible, and are called membranaceous. Caterpillars also, with regard to their external figure, are either smooth, or hairy. The skin of the first kind is soft to the touch, or hard, like shagreen; the skin of the latter, is hairy, and as it were thorny; and generally, if handled, stings like nettles. Some of them even cause this stinging pain, if but approached too nearly.

Caterpillars, in general, have six small black spots placed on the circumference of the fore ring, and a little to the side of the head. Three of these are larger than the rest, and are convex and transparent; these Reaumur takes to be the eyes of the caterpillar; however, most of these reptiles have very little occasion for sight, and seem only to be directed by their feeling.

But the parts of the caterpillar's body which most justly demand our attention, are the stigmata, as they are called; or those holes on the sides of its body, through which the animal is supposed to breathe. All along this insect's body, on each side, these holes are easily discoverable. They are eighteen in number, nine on a side, rather nearer the belly than the back; a hole for every ring, of which the animal's body is composed, except the second, the third, and the last. These oval openings may be considered as so many mouths, through which the insect breathes; but with this difference, that as we have but one pair of lungs, the caterpillar has no less than eighteen. It requires no great anatomical dexterity to discover these lungs in the larger kind of caterpillars; they appear, at first view, to be hollow cartilaginous tubes, and of the colour of mother-of-pearl. These tubes are often seen to unite with each other; some are perceived to open into the intestines; and some go to different parts of the surface of the body. That these vessels serve to convey the air, appears evidently, from the famous experiment of Malpighi; who, by stopping up the mouths of the stigmata with oil, quickly suffocated the animal, which was seen to die convulsed the instant after. In order to ascertain his theory, he rubbed oil upon other parts of the insect's body, leaving the stigmata free; and this seemed to have no effect upon the animal's health, but it continued to move and eat as usual; he rubbed oil on the stigmata of one side, and the animal underwent a partial convulsion, but recovered soon after. However it ought to be observed, that air is not so necessary to these as to the nobler ranks of animals, since caterpillars will live in an exhausted receiver for several days together; and though they seem dead at the bottom, yet, when taken out, recover, and resume their former vivacity.

If the caterpillar be cut open longitudinally along the back, its intestines will be perceived running directly in a straight line from the mouth to the anus. They resemble a number of small bags opening into each other; and strengthened on both sides by a fleshy cord, by which they are united. These insects are, upon many occasions, seen

to cast forth the internal coat of their intestines with their food, in the changes which they so frequently undergo. But the intestines take up but a small part of the animal's body, if compared to the fatty substance in which they are involved. This substance changes its colour when the insect's metamorphosis begins to approach; and from white it is usually seen to become yellow. If to these parts, we add the caterpillar's implements for spinning, (for all caterpillars spin at one time or another) we shall have a rude sketch of this animal's conformation: however we shall reserve the description of those parts, till we come to the history of the silk-worm, where the manner in which these insects spin their webs, will most properly find place.

The life of a caterpillar seems one continued succession of changes; and it is seen to throw off one skin only to assume another; which also is divested in its turn: and thus for eight or ten times successively. We must not, however, confound this changing of the skin with the great metamorphosis which it is afterwards to undergo. The throwing off one skin, and assuming another, seems, in comparison, but a slight operation among these animals: this is but the work of a day; the other is the great adventure of their lives. Indeed, this faculty of changing the skin, is not peculiar to caterpillars only, but is common to all the insect kind; and even to some animals that claim a higher rank in Nature. We have already seen the lobster and the crab out-growing their first shells, and then bursting from their confinement, in order to assume a covering more roomy and convenient. It is probable that the louse, the flea, and the spider, change their covering from the same necessity; and growing too large for the crust in which they have been for some time inclosed, burst it for another. This period is probably that of their growth; for as soon as their new skin is hardened round them, the animal's growth is necessarily circumscribed, while it remains within it. With respect to caterpillars, many of them change their skins five or six times in a season; and this covering, when cast off, often seems so complete, that many might mistake the empty skin for the real insect. Among the hairy caterpillars, for instance, the cast skin is covered with hair; the feet, as well grisly as membranous, remain fixed to it; even the parts which nothing but a microscope can discover, are visible in it; in short, all the parts of the head; not only the skull but the teeth.

In proportion as the time approaches in which the caterpillar is to cast its old skin, its colours become more feeble, the skin seems to wither and grow dry, and in some measure resembles a leaf, when it is no longer supplied with moisture from the stock. At that time, the insect begins to find itself under a necessity of changing; and it is not effected without violent labour, and perhaps pain. A day or two before the critical hour approaches, the insect ceases to eat, loses its usual activity, and seems to rest immovable. It seeks some place to remain in security; and no longer timorous, seems regardless even of the touch. It is now and then seen to bend itself and elevate its back; again it stretches to its utmost extent: it sometimes lifts up the head, and then lets it fall again; it sometimes waves at three or four times from side to side, and then remains in quiet. At length, some of the rings of its body, particularly the first and second, are seen to swell considerably, the old skin distends and bursts, till, by repeated swellings

ings and contractions in every ring, the animal disengages itself, and creeps from its inconvenient covering.

How laborious soever this operation may be, it is performed in the space of a minute; and the animal, having thrown off its old skin, seems to enjoy new vigour, as well as to have acquired colouring and beauty. Sometimes it happens that it takes a new appearance and colours very different from the old. Those that are hairy, still preserve their covering; although their ancient skin seems not to have lost a single hair: every hair appears to have been drawn, like a sword from the scabbard. However the fact is, that a new crop of hair grows between the old skin and the new, and probably helps to throw off the external covering.

The caterpillar having in this manner continued for several days feeding, and at intervals casting its skin, begins at last to prepare for its change into an aurelia. It is most probable that, from the beginning, all the parts of the butterfly lay hid in this insect, in its reptile state; but it required time to bring them to perfection; and a large quantity of food, to enable the animal to undergo all the changes requisite for throwing off these skins, which seemed to clog the butterfly form. However, when the caterpillar has fed sufficiently, and the parts of the future butterfly have formed themselves beneath its skin, it is then time for it to make its first, great, and principal change into an aurelia, or a crysalis, as some have chosen to call it; during which, as was observed, it seems to remain for several days, or even months, without life or motion.

Preparatory to this important change, the caterpillar most usually quits the plant, or the tree on which it fed; or at least attaches itself to the stalk or the stem, more gladly than the leaves. It forsakes its food, and prepares, by fasting, to undergo its transmutation. In this period, all the food it has taken is thoroughly digested; and it often voids even the internal membrane which lined its intestines. Some of this tribe, at this period also, are seen entirely to change colour; and the vivacity of the tints, in all, seems faded. Those of them which are capable of spinning themselves a web, set about this operation; those which have already spun, await the change in the best manner they are able. The web or cone, with which some cover themselves, hides the aurelia contained within from the view; but in others, where it is more transparent, the caterpillar, when it has done spinning, strikes into it the claws of the two feet under the tail, and afterwards forces in the tail itself, by contracting those claws, and violently striking the feet one against the other. If, however, they be taken from their web at this time, they appear in a state of great languor; and, incapable of walking, remain on that spot where they are placed. In this condition they remain one or two days, preparing to change into an aurelia; somewhat in the manner they made preparations for changing their skin. They then appear with their bodies bent into a bow, which they now and then are seen to straighten: they make no use of their legs; but if they attempt to change place, do it by the contortions of their body. In proportion as their change into an aurelia approaches, their body becomes more and more bent; while their extensions and convulsive contractions become more frequent. The hinder end of the body is the part which the animal first disengages from its caterpillar skin; that part of the skin remains empty, while the body is drawn up contracted-
ly

ly towards the head. In the same manner they disengage themselves from the two succeeding rings; so that the animal is then lodged entirely in the fore part of its caterpillar covering: that half which is abandoned, remains flaccid and empty; while the fore part, on the contrary, is swollen and distended. The animal, having thus quitted the hinder part of its skin, to drive itself up into the fore part, still continues to heave and work as before; so that the skull is soon seen to burst into three pieces, and a longitudinal opening is made in the three first rings of the body, through which the insect thrusts forth its naked body with strong efforts. Thus at last it entirely gets free from its caterpillar skin, and for ever forsakes its most odious reptile form.

The caterpillar, thus stripped of its skin for the last time, is now become an aurelia; in which the parts of the future butterfly are all visible; but in so soft a state, that the smallest touch can discompose them. The animal is now become helpless and motionless; but only waits for the assistance of the air to dry up the moisture on its surface, and supply it with a crust capable of resisting external injuries. Immediately after being stripped of its caterpillar skin, it is of a green colour, especially in those parts, which are distended by an extraordinary afflux of animal moisture; but in ten or twelve hours after being thus exposed, its parts harden, the air forms its external covering into a firm crust, and in about four and twenty hours, the aurelia may be handled without endangering the little animal that is thus left in so defenceless a situation. Such is the history of the little pod or cone that is found so common by every pathway, sticking to nettles, and sometimes shining like polished gold. From the beautiful and resplendent colour, with which it is thus sometimes adorned, some authors have called it a Chrysalis, implying a creature made of gold.

Such are the efforts by which these little animals prepare for a state of perfection; but their care is still greater to provide themselves a secure retreat, during this season of their imbecility. It would seem like erecting themselves a monument, where they were to rest secure, until Nature had called them into a new and more improved existence. For this purpose, some spin themselves a cone or web, in which they lie secure till they have arrived at maturity: others, that cannot spin so copious a covering, suspend themselves by the tail, in some retreat where they are not likely to meet disturbances. Some mix sand with their gummy and moist webs, and thus make themselves a secure incrustation; while others, before their change, bury themselves in the ground, and thus avoid the numerous dangers that might attend them. One would imagine that they were conscious of the precise time of their continuance in their aurelia state; since their little sepulchres, with respect to the solidity of the building, are proportioned to such duration. Those that are to lie in that state of existence but a few days, make choice of some tender leaf, which they render still more pliant by diffusing a kind of glue upon it: the leaf thus gradually curls up, and withering as it enfolds, the insect wraps itself within, as in a mantle, till the genial warmth of the sun enables it to struggle for new life, and burst from its confinement. Others, whose time of transformation is also near at hand, fasten their tails to a tree, or to the first worm hole they meet, in a beam, and wait in that defenceless situation. Such caterpillars, on the other hand, are seen to lie several months in their aurelia state,

act with much greater circumspection. Most of them mix their web with sand, and thus make themselves a strong covering: others build in wood, which serves them in the nature of a coffin. Such as have made the leaves of willows their favourite food, break the tender twigs of them first into small pieces, then pound them as it were to powder; and, by means of their glutinous silk, make a kind of paste, in which they wrap themselves up. Many are the forms which these animals assume in this helpless state; and it often happens, that the most deformed butterflies issue from the most beautiful aurelias.

In general, however, the aurelia takes the rude outline of the parts of the animal which is contained within it; but as to the various colours which it is seen to assume, they are rather the effect of accident; for the same species of insect does not at all times assume the same hue, when it becomes an aurelia. In some, the beautiful gold colour is at one time found; in others, it is wanting. This brilliant hue, which does not fall short of the best gilding, is formed in the same manner in which we see leather obtain a gold colour, though none of that metal ever enters into the tincture. It is only formed by a beautiful brown varnish, laid upon a white ground; and the white thus gleaming through the transparency of the brown, gives a charming golden yellow. These two colours are found, one over the other, in the aurelia of the little animal we are describing; and the whole appears gilded, without any real gilding.

The aurelia thus formed, and left to time to expand into a butterfly, in some measure resembles an animal in an egg, that is to wait for external warmth to hatch it into life and vigour. As the quantity of moisture that is enclosed within the covering of the aurelia, continues to keep its body in the most tender state, so it is requisite that this humidity should be dried away, before the little butterfly can burst its prison. Many have been the experiments to prove that Nature may in this respect be assisted by art; and that the life of the insect may be retarded or quickened, without doing it the smallest injury. For this purpose, it is only requisite to continue the insect in its aurelia state, by preventing the evaporation of its humidity; which will consequently add some days, nay weeks, to its life: on the other hand, by evaporating its moisture, in a warm situation, the animal assumes its winged state before its usual time, and goes through the offices assigned its existence. To prove this, Mr Reaumur enclosed the aurelia in a glass tube; and found the evaporated water, which exhaled from the body of the insect, collected in drops at the bottom of the tube: he covered the aurelia with varnish; and this making the evaporation more difficult and slow, the butterfly was two months longer than its natural term, in coming out of its case: he found, on the other hand, that by laying the animal in a warm room, he hastened the disclosure of the butterfly; and by keeping it in an ice-house in the same manner, he delayed it. Warmth acted, in this case, in a double capacity; invigorating the animal, and evaporating the moisture.

The aurelia, though it bears a different external appearance, nevertheless contains within it all the parts of the butterfly in perfect formation; and lying each in a very orderly manner, though in the smallest compass. These, however, are so fast and tender, that it is impossible to visit without discomposing them. When either by warmth, or increasing

creasing vigour, the parts have acquired the necessary force and solidity, the butterfly then seeks to disembarrafs itself of those bands which kept it so long in confinement. Some insects continue under the form of an aurelia not above ten days; some twenty; some several months; and even for a year together.

The butterfly, however, does not continue so long under the form of an aurelia, as one would be apt to imagine. In general, those caterpillars that provide themselves with cones, continue within them but a few days after the cone is completely finished. Some, however, remain buried in this artificial covering for eight or nine months, without taking the smallest sustenance during the whole time: and though in the caterpillar state no animals were so voracious, when thus transformed, they appear a miracle of abstinence. In all, sooner or later, the butterfly bursts from its prison; not only that natural prison which is formed by the skin of the aurelia, but also from that artificial one of silk, or any other substance in which it has enclosed itself.

The efforts which the butterfly makes to get free from its aurelia state, are by no means so violent as those which the insect had in changing from the caterpillar into the aurelia. The quantity of moisture surrounding the butterfly is by no means so great as that attending its former change; and the shell of the aurelia is so dry, that it may be cracked between the fingers.

If the animal be shut up within a cone, the butterfly always gets rid of the natural internal skin of the aurelia, before it eats its way through the external covering which its own industry has formed round it. In order to observe the manner in which it thus gets rid of the aurelia covering, we must cut open the cone, and then we shall have an opportunity of discovering the insect's efforts to emancipate itself from its natural shell. When this operation begins, there seems to be a violent agitation in the humours contained within the little animal's body. Its fluids seem driven, by an hasty fermentation, through all the vessels; while it labours violently with its legs, and makes several other violent struggles to get free. As all these motions concur with the growth of the insect's wings and body, it is impossible that the brittle skin which covers it should longer resist: it at length gives way, by bursting into four distinct and regular pieces. The skin of the head and legs first separates; then the skin at the back flies open, and dividing into two regular portions, disengages the back and wings: then there likewise happens another rupture in that portion which covered the rings of the back of the aurelia. After this, the butterfly, as if fatigued with its struggles, remains very quiet for some time, with its wings pointed downwards, and its legs fixed in the skin which it had just thrown off. At first sight the animal, just set free, and permitted the future use of its wings, seems to want them entirely: they take up such little room, that one would wonder where they were hidden. But soon after, they expand so rapidly, that the eye can scarce attend their unfolding. From reaching scarce half the length of the body, they acquire, in a most wonderful manner, their full extent and bigness, so as to be each five times larger than they were before. Nor is it the wings alone that are thus increased: all their spots and paintings, before so minute as to be scarce discernible, are proportionably extended; so that, what a few minutes before seemed only a number of confused, unmeaning points,

points, now become distinct and most beautiful ornaments. Nor are the wings, when they are thus expanded, unfolded in the manner in which earwigs and grasshoppers display theirs, who unfurl them like a lady's fan: on the contrary, those of butterflies actually grow to their natural size in this very short space. The wing, at the instant it is freed from its late confinement, is considerably thicker than afterwards; so that it spreads in all its dimensions, growing thinner as it becomes broader. If one of the wings be plucked from the animal just set free, it may be spread by the fingers, and it will soon become as broad as the other, which has been left behind. As the wings extend themselves so suddenly, they have not yet had time to dry; and accordingly appear like pieces of wet paper, soft, and full of wrinkles. In about half an hour, they are perfectly dry, their wrinkles entirely disappear, and the little animal assumes all its splendour. The transmutation being thus perfectly finished, the butterfly discharges three or four drops of a blood-coloured liquid, which are the last remains of its superfluous moisture. Those aurelias which are enclosed within a cone, find their exit more difficult, as they have still another prison to break through: this, however, they perform in a short time; for the butterfly, freed from its aurelia skin, butts with its head violently against the walls of its artificial prison; and probably with its eyes, that are rough and like a file, it rubs the internal surface away; till it is at last seen bursting its way into open light; and, in less than a quarter of an hour, the animal acquires its full perfection.

Thus, to use the words of Swammerdam, we see a little insignificant creature distinguished, in its last birth, with qualifications and ornaments, which man, during his stay upon earth, can never even hope to acquire. The butterfly, to enjoy life, needs no other food but the dews of Heaven; and the honeyed juices which are distilled from every flower. The pageantry of princes cannot equal the ornaments with which it is invested; nor the rich colouring that embellishes its wings. The skies are the butterfly's proper habitation, and the air its element: whilst man comes into the world naked, and often roves about without habitation or shelter; exposed, on one hand, to the heat of the sun; and, on the other, to the damps and exhalations of the earth; both alike enemies of his happiness and existence.—A strong proof that, while this little animal is raised to its greatest height, we are as yet, in this world, only candidates for perfection!

It has been already shewn that all Butterflies are bred from caterpillars; and we have exhibited the various circumstances of that surprising change. It has been remarked, that butterflies may be easily distinguished from flies of every other kind, by their wings; for, in others, they are either transparent, like gauze, as we see in the common flesh fly; or they are hard and crusted, as we see the wings of the beetle. But in the butterfly, the wings are soft, opake, and painted over with a beautiful dust, that comes off with handling.

The number of these beautiful animals is very great; and though Linnæus has reckoned up above seven hundred and sixty different kinds, the catalogue is still very incomplete. Every collector of butterflies can shew undescribed species: and such as are fond of minute discovery, can here produce animals that have been examined only by himself. In general, however, those of the warm climates, are larger and more

beautiful than such as are bred at home; and we can easily admit the beauty of the butterfly, since we are thus freed from the damage of the caterpillar. It has been the amusement of some to collect these animals, from different parts of the world; or to breed them from caterpillars at home. These they arrange in systematic order; or dispose so as to make striking and agreeable pictures: and all must grant, that this specious idleness is far preferable to that unhappy state which is produced by a total want of employment.

The wings of butterflies, as was observed, fully distinguish them from flies of every other kind. They are four in number; and though two of them be cut off, the animal can fly with the two others remaining. They are, in their own substance, transparent; but owe their opacity to the beautiful dust with which they are covered; and which has been likened, by some naturalists, to the feathers of birds; by others, to the scales of fishes; as their imaginations were disposed to catch the resemblance. In fact, if we regard the wing of a butterfly with a good microscope, we shall perceive it studded over with a variety of little grains of different dimensions and forms, generally supported upon a foot-stalk, regularly laid upon the whole surface. Nothing can exceed the beautiful and regular arrangement of these little substances: which thus serve to paint the butterfly's wing, like the tiles of an house. Those of one rank are a little covered by those that follow: they are of many figures: on one part of the wing may be seen a succession of oval studs; on another part, a cluster of studs, each in the form of an heart: in one place they resemble a hand open; and in another they are long or triangular; while all are interspersed with taller studs, that grow between the rest like mushrooms upon a stalk. The wing itself is composed of several thick nerves, which render the construction very strong, though light; and though it be covered over with thousands of these scales or studs, yet its weight is very little increased by the number. The animal is with ease enabled to support itself a long while in air, although its flight be not very graceful. When it designs to fly to a considerable distance, it ascends and descends alternately; going sometimes to the right, sometimes to the left, without any apparent reason. Upon closer examination, however, it will be found that it flies thus irregularly in pursuit of its mate; and as dogs bait and quarter the ground in pursuit of their game, so these insects traverse the air, in quest of their mates whom they can discover at more than a mile's distance.

If we prosecute our description of the butterfly, the animal may be divided into three parts; the head, the corselet, and the body.

The body is the hinder part of the butterfly, and is composed of rings, which are generally concealed under long hair, with which that part of the animal is clothed. The corselet is more solid than the rest of the body, because the fore wings, and the legs are fixed therein. The legs are fix in number, although four only are made use of by the animal; the two fore legs being often so much concealed in the long hair of the body, that it is sometimes difficult to discover them. If we examine these parts internally, we shall find the same set of vessels in the butterfly that we observed in the caterpillar, but with this great difference, that as the blood, or humours, in the caterpillar, circulated from the tail to the head, they are found, in the butterfly, to take a direct

direct contrary course, and to circulate from the head to the tail; so that the caterpillar may be considered as the embryo animal, in which, as we have formerly seen, the circulation is carried on differently from what it is in animals when excluded.

But leaving the other parts of the butterfly, let us turn our attention particularly to the head. The eyes of butterflies have not all the same form; for in some they are large, in others small; in some they are the larger portion of a sphere, in others they are but a small part of it, and just appearing from the head. In all of them, however, the outward coat has a lustre, in which may be discovered the various colours of the rainbow. When examined a little closely, it will be found to have the appearance of a multiplying glaiss; having a great number of sides, or facets, in the manner of a brilliant cut diamond. In this particular, the eye of the butterfly, and of most other insects, entirely correspond; and Luenhoek pretends, there are above six thousand facets on the cornea of a flea. These animals, therefore, see not only with great clearness; but view every object multiplied in a surprising manner. Puget adapted the cornea of a flea in such a position, as to see objects through it by the means of a microscope; and nothing could exceed the strangeness of its representations: a soldier, who was seen through it, appeared like an army of pygmies; for while it multiplied, it also diminished the object: the arch of a bridge exhibited a spectacle more magnificent than human skill could perform; the flame of a candle seemed a beautiful illumination. It still, however, remains a doubt, whether the insect sees objects singly, as with one eye; or whether every facet is itself a complete eye, exhibiting its own object distinct from all the rest.

Butterflies, as well as most other flying insects, have two instruments, like horns, on their heads which are commonly called feelers. They differ from the horns of greater animals, in being moveable at their base; and having a great number of joints, by which means the insect is enabled to turn them in every direction. Those of butterflies are placed at the top of the head, pretty near the external edge of each eye. What the use of these instruments may be, which are thus formed with so much art, and by a Workman who does nothing without reason, is as yet unknown to man. They may serve to guard the eye; they may be of use to clean it; or they may be the organ of some sense which we are ignorant of: but this is only explaining one difficulty by another.

We are not so ignorant of the uses of the trunk, which few insects of the butterfly kind are without. This instrument is placed exactly between the eyes; and when the animal is not employed in seeking its nourishment, it is rolled up, like a curl. A butterfly, when it is feeding, flies round some flower, and settles upon it. The trunk is then uncurled, and thrust out either wholly or in part; and is employed in searching the flower to its very bottom, let it be ever so deep. This search being repeated seven or eight times, the butterfly then passes to another; and continues to hover over those agreeable to its taste, like a bird over its prey. This trunk consists of two equal hollow tubes, nicely joined to each other, like the pipes of an organ.

Such is the figure and conformation of these beautiful insects, that cheer our walks, and give us the earliest intimations of summer. But it is not by day alone that they are seen fluttering wantonly from flower

to flower, as the greatest number of them fly by night, and expand the most beautiful colouring, at those hours when there is no spectator. This tribe of insects has therefore been divided into Diurnal and Nocturnal Flies; or, more properly speaking, into Butterflies and Moths: the one only flying by day, the other most usually on the wing in the night. They may be easily distinguished from each other, by their horns or feelers: those of the butterfly being clubbed, or knobbed at the end; those of the moth, tapering finer and finer to a point. To express it technically—the feelers of the butterflies are clavated; those of moths, are filiform.

The butterflies, as well as the moths, employ the short life assigned them, in a variety of enjoyments. Their whole time is spent either in quest of food, which every flower offers; or in pursuit of the female, whose approach they can often perceive at a very great distance. Their sagacity in this particular is not less astonishing than true; but by what sense they are thus capable of distinguishing each other at such distances, is not easy to conceive. It cannot be by the sight, since such small objects as they are must be utterly imperceptible, at half the distance at which they perceive each other: it can scarcely be by the sense of smelling, since the animal has no organs for that purpose. Whatever be their powers of perception, certain it is, that the male, after having fluttered, as if carelessly, about for some time, is seen to take wing, and go forward, sometimes for two miles together, in a direct line to where the female is perched on a flower.

The general rule among insects is, that the female is larger than the male; and this obtains particularly in the tribe I am describing. The body of the male is smaller and slenderer; that of the female, more thick and oval. Previous to the junction of these animals, they are seen sporting in the air, pursuing and flying from each other, and preparing, by a mock combat, for the more important busines of their lives. If they be disturbed while united, the female flies off with the male on her back, who seems entirely passive upon the occasion.

But the females of many moths and butterflies seem to have assumed their airy form for no other reason but to fecundate their eggs, and lay them. They are not seen fluttering about in quest of food, or a mate: all that passes, during their short lives, is a junction with the male of about half an hour; after which they deposit their eggs, and die, without taking any nourishment, or seeking any. It may be observed, however, that in all the females of this tribe, they are impregnated by the male by one aperture, and lay their eggs by another.

The eggs of female butterflies are disposed in the body like a bed of chaplets; which, when excluded, are usually oval, and of a whitish colour: some, however, are quite round; and others flattened, like a turnip. The covering or shell of the egg, though solid, is thin and transparent; and in proportion as the caterpillar grows within the egg, the colours change, and are distributed differently. The butterfly seems very well instructed by nature in its choice of the plant, or the leaf, where it shall deposit its burthen. Each egg contains but one caterpillar; and it is requisite that this little animal, when excluded, should be near its peculiar provision. The butterfly, therefore, is careful to place her brood only upon those plants that afford good nourishment to its posterity. Though the little winged animal has been fed itself upon

upon dew, or the honey of flowers, yet it makes choice for its young of a different provision, and lays its eggs on the most unsavoury plants; the rag-weed, the cabbage, or the nettle. Thus every butterfly chuses not the plant most grateful to it in its winged state; but such as it has fed upon in its reptile form.

All the eggs of butterflies are attached to the leaves of the favourite plant, by a sort of size or glue; where they continue, unobserved, unless carefully sought after. The eggs are sometimes placed round the tender shoots of plants, in the form of bracelets, consisting of above two hundred in each, and generally surrounding the shoot, like a ring upon a finger. Some butterflies secure their eggs from the injuries of air, by covering them with hair, plucked from their own bodies, as birds sometimes are seen to make their nests; so that their eggs are thus kept warm, and also entirely concealed.

All the tribe of female moths lay their eggs a short time after they leave the aurelia; but there are many butterflies that flutter about the whole summer, and do not think of laying, till the winter begins to warn them of their approaching end; some even continue the whole winter in hollows of trees, and do not provide for posterity until the beginning of April, when they leave their retreats, deposit their eggs, and die. Their eggs soon begin to feel the genial influence of the season: the little animals burst from them in their caterpillar state, to become aurelias, and butterflies in their turn; and thus continue the round of Nature.

Nature, though it has rendered some animals surprisingly fruitful, yet ever takes care to prevent their too great increase. One set of creatures is generally opposed to another: and those are chiefly the most prolific, that are, from their embecility, incapable of making any effectual defence. The caterpillar has perhaps, of all other animals, the greatest number of enemies; and seems only to exist, by its surprising fecundity. Some animals devour them by hundreds; others, more minute, yet more dangerous, mangle them in various ways: so that, how great soever their numbers may be, their destroyers are in equal proportion. Indeed, if we consider the mischiefs these reptiles are capable of occasioning, and the various damages we sustain from their insatiable rapacity, it is happy for the other ranks of Nature, that there are thousands of fishes, birds, and even insects, that live chiefly upon caterpillars, and make them their most favourite repast.

When we described the little birds that live in our gardens, and near our houses, as destructive neighbours, sufficient attention was not paid to the services which they are frequently found to render us. It has been proved, that a single sparrow and its mate, that have young ones, destroy above three thousand caterpillars in a week; not to mention several butterflies, in which numberless caterpillars are destroyed in embryo. It is in pursuit of these reptiles that we are favoured with the visits of many of our most beautiful songsters; that amuse us during their continuance and leave us when the caterpillars disappear.

The maxim which has often been urged against man; that he, of all other animals, is the only creature that is an enemy to his own kind, and that the human species only are found to destroy each other, has been adopted, by persons who never considered the history of insects. Some of the caterpillar kind in particular, that seem fitted only to live

upon leaves and plants, will, however, eat each other; and the strongest will devour the weak, in preference to their vegetable food. That which lives upon the oak, is found to seize any of its companions, which it conveniently can, by the first rings, and inflict a deadly wound: it then feasts in tranquillity on its prey, and leaves nothing of the animal but the husk.

But it is not from each other they have most to fear, as in general they are inoffensive; and many of this tribe are found to live in a kind of society. Many kinds of flies lay their eggs either upon, or within their bodies; and as these turn into worms, the caterpillar is seen to nourish a set of intestine enemies within its body, that must shortly be its destruction: Nature having taught flies, as well as all other animals, the surest methods of perpetuating their kind.—“ Towards the end of August,” says Reaumur, “ I perceived a little fly, of a beautiful gold colour, busily employed in the body of a large caterpillar, of that kind which feeds upon cabbage, I gently separated that part of the leaf on which these insects were placed, from the rest of the plant, and placed it where I might observe them more at my ease. The fly wholly taken up by the business in which it was employed, walked along the caterpillar’s body, now and then remaining fixed to a particular spot. Upon this occasion, I perceived it every now and then dart a sting, which it carried at the end of its tail, into the caterpillar’s body, and then drew it out again, to repeat the same operation in another place. It was not difficult for me to conjecture the business which engaged this animal so earnestly; its whole aim was to deposit its eggs in the caterpillar’s body; which was to serve as a proper retreat for bringing them to perfection. The reptile thus rudely treated, seemed to bear all very patiently, only moving a little when stung too deeply; which, however, the fly seemed entirely to disregard. I took particular care to feed this caterpillar; which seemed to me to continue as voracious and vigorous as any of the rest of this kind. In about ten or twelve days, it changed into an aurelia, which seemed gradually to decline, and died: upon examining its internal parts, the animal was entirely devoured by worms; which, however, did not come to perfection, as it is probable they had not enough to sustain them within.”

What the French philosopher perceived upon this occasion, is every day to be seen in several of the larger kinds of caterpillars, whose bodies serve as a nest to various flies, that very carefully deposit their eggs within them. The large cabbage caterpillar is so subject to its injuries that, at certain seasons, it is much easier to find them with than without them. The ichneumon fly, as it is called, particularly infests these reptiles, and prevents their fecundity. This fly is of all others, the most formidable to insects of various kinds. The spider, that destroys the ant, the moth, and the butterfly, yet often falls a prey to the ichneumon; who pursues the robber to his retreat, and, despising his nets, tears him in pieces, in the very labyrinth he has made. This insect, as redoubtable as the little quadruped that destroys the crocodile, has received the same name; and from its destruction of the caterpillar tribe, is probably more serviceable to mankind. This insect, I say, makes the body of the caterpillar the place for depositing its eggs; to the number of ten, fifteen, or twenty. As they are laid in those parts which are not mortal, the reptile still continues to live, and to feed,

feed, shewing no signs of being incommoded by its new guests. The caterpillar changes its skin ; and sometimes undergoes the great change into an aurelia : but still the fatal intruders work within, and secretly devour its internal substance : soon after they are seen bursting through its skin, and moving away, in order to spin themselves a covering, previous to their own little transformation. It is indeed astonishing sometimes to see the number of worms, and those pretty large, that thus issue from the body of a single caterpillar, and eat their way through its skin : but it is more extraordinary still, that they should remain within the body, devouring its entrails, without destroying its life. The truth is, they seem instructed by Nature not to devour its vital parts ; for they are found to feed only upon that fatty substance which composes the largest part of the caterpillar's body. When this surprising appearance was first observed, it was supposed that the animal thus gave birth to a number of flies, different from itself ; and that the same caterpillar sometimes bred an ichneumon, and sometimes a butterfly : but it was not till after more careful inspection, it was discovered, that the ichneumon tribe were not the caterpillar's offspring, but its murderers.

Having before mentioned the damages inflicted by the caterpillar tribe, we now come to an animal of this kind, that alone compensates for all the mischief occasioned by the rest. This little creature, which only works for itself, has been made of the utmost service to man ; and furnishes him with a covering more beautiful than any other animal can supply. We may declaim indeed against the luxuries of the times, when silk is so generally worn ; but were such garments to fail, what other arts could supply their deficiency ?

Though silk was anciently brought in small quantities to Rome, yet it was so scarce as to be sold for its weight in gold ; and was considered as such a luxurious refinement in dress, that it was infamous for a man to appear in habbits of which silk formed but half the composition. It was most probably brought among them from the remotest parts of the East ; since it was, at the time of which I am speaking, scarcely known even in Persia.

Nothing can be more remote from the truth, than the manner in which their historians describe the animal by which silk is produced. Pausanius informs us, that silk came from the country of the Seres, a people of Asiatic Scythia ; in which place an insect, as large as the beetle, but in every other respect resembling a spider, was bred up for that purpose. They take great care, as he assures us, to feed and defend it from the weather ; as well during the summer's heat, as the rigours of winter. This insect, he observes, makes its web with its feet, of which it has eight in number. It is fed, for the space of four years, upon a kind of paste, prepared for it ; and at the beginning of the fifth, it is supplied with the leaves of the green willow, of which it is particularly fond. It then feeds till it bursts with fat ; after which they take out its bowels, which are spun into the beautiful manufacture so scarce and costly.

The real history of this animal was unknown among the Romans till the times of Justinian ; and it is supposed, that silkworms were not brought into Europe till the beginning of the twelfth century, when Roger of Sicily brought workmen in this manufacture from Asia Minor, after his return from his expedition to the Holy Land, and settled them

in Sicily and Calabria. From these the other kingdoms of Europe learned this manufacture; and it is now one of the most lucrative carried on among the southern provinces of Europe.

The silkworm is now very well known to be a large caterpillar, of a whitish colour, with twelve feet, and producing a butterfly of the moth kind. The cone on which it spins, is formed for covering it while it continues in the aurelia state; and several of these, properly wound off, and united together, form those strong and beautiful threads, which are woven into silk. The feeding these worms, the gathering, the winding, the twisting, and the weaving their silk, is one of the principal manufactures of Europe; and, as our luxuries increase, seems every day more and more necessary to human happiness.

There are two methods of breeding silk-worms; for they may be left to grow, and remain at liberty upon the trees where they are hatched; or they may be kept in a place built for that purpose, and fed every day with fresh leaves. The first method is used in China, Tonquin, and other hot countries; the other is used in those places where the animal has been artificially propagated, and still continues a stranger. In the warm climates, the silk worm proceeds from an egg, which has been glued by the parent moth upon proper parts of the mulberry-tree, and which remains in that situation during the winter. The manner in which they are situated and fixed to the tree, keeps them unaffected by the influence of the weather; so that those frosts which are severe enough to kill the tree, have no power to injure the silkworm.

The insect never proceeds from the egg till Nature has provided it a sufficient supply; and till the budding leaves are furnished, in sufficient abundance, for its support. When the leaves are put forth, the worms seem to feel the genial summons, and bursting from their little eggs, crawl upon the leaves, where they feed with a most voracious appetite. Thus they become larger by degrees; and after some months feeding, they lay, upon every leaf, small bundles, or cones of silk, which appear like so many golden apples, painted on a fine green ground. Such is the method of breeding them in the East; and without doubt it is best for the worms, and least troublesome for the feeder of them. But it is otherwise in our colder European climates; the frequent changes of the weather, and the heavy dews of our evenings, render the keeping them all night exposed, subject to so many inconveniences, as to admit of no remedy. It is true, that by the assistance of nets, they may be preserved from the insults of birds; but the severe cold weather, which often succeeds the first heats of summer, as well as the rain and high winds, will destroy them all: and, therefore, to breed them in Europe, they must be sheltered and protected from every external injury.

For this purpose, a room is chosen, with a south aspect; and the windows are so well glazed, as not to admit the least air: the walls are well built, and the planks of the floor exceeding close, so as to admit neither birds nor mice, nor even so much as an insect. In the middle there should be four pillars erected, or four wooden posts, so placed as to form a pretty large square. Between these are different stories made with osier hurdles; and under each hurdle there should be a floor, with an upright border all round. These hurdles and floors must hang upon pulleys, so as to be placed, or taken down at pleasure.

When

When the worms are hatched, some tender mulberry leaves are provided, and placed in the cloth or paper box in which the eggs were laid, and which are large enough to hold a great number. When they have acquired some strength, they must be distributed on beds of mulberry leaves, in the different stories of the square in the middle of the room, round which a person may freely pass on every side. They will fix themselves to the leaves, and afterwards to the sticks of the hurdles, when the leaves are devoured. They have then a thread, by which they can suspend themselves on occasion, to prevent any shock by a fall; but this is by no means to be considered, as the silk which they spin afterwards in such abundance. Care must be taken that fresh leaves be brought every morning, which must be strewed very gently and equally over them; upon which the silk worms will forsake the remainder of the old leaves, which must be carefully taken away, and every thing kept very clean; for nothing hurts these insects so much as moisture and uncleanliness. For this reason their leaves must be gathered when the weather is dry, and kept in a dry place, if it be necessary to lay in store. As these animals have but a short time to live, they make use of every moment, and almost continually are spinning, except at those intervals when they change their skins. If mulberry leaves be difficult to be obtained, the leaves of lettuce or holyoak will sustain them: but they do not thrive so well upon their new diet; and their silk will neither be so copious, nor of so good a quality.

Though the judicious choice, and careful management of their diet, is absolutely necessary, yet there is another precaution of equal importance, which is to give them air, and open their chamber windows, at such times as the sun shines warmest. The place also must be kept as clean as possible; not only the several floors that are laid to receive their ordure, but the whole apartments in general. These things well observed, contribute greatly to their health and increase.

The worm, at the time it bursts the shell, is extremely small, and of a black colour; but the head is of a more shining black than the rest of the body: some days after, they begin to turn whitish, or of an ash-coloured grey. After the skin begins to grow too rigid, or the animal is stinted within it, the insect throws it off, and appears clothed a-new: it then becomes larger and much whiter, though it has a greenish cast: after some days, which are more or less, according to the different heat of the climate, or to the quality of the food, it leaves off eating, and seems to sleep for two days together: then it begins to stir, and put itself into violent motions, till the skin fall off the second time, and is thrown aside by the animal's feet. All these changes are made in three weeks or a month's time; after which it begins to feed once more, still in its caterpillar form, but a good deal differing from itself before its change. In a few days' time it seems to sleep again; and, when it awakes, it again changes its clothing, and continues feeding as before. When it has thus taken a sufficiency of food, and its parts are disposed for assuming the aurelia form, the animal forsakes for the last time, all food and society, and prepares itself a retreat to defend it from external injuries, while it is seemingly deprived of life and motion.

This retreat is no other than its cone, or ball of silk, which Nature has taught it to compose with great art; and within which it buries

itself, till it assumes its winged form. This cone or ball is spun from two little longish kinds of bags that lie above the intestines, and are filled with a gummy fluid, of a marigold colour. This is the substance of which the threads are formed; and the little animal is furnished with a surprising apparatus for spinning it to the degree of fineness which its occasions may require. This instrument in some measure resembles a wire-drawer's machine, in which gold or silver threads are drawn to any degree of minuteness; and through this the animal draws its thread with great assiduity. As every thread proceeds from two gum bags, it is probable that each supplies its own; which, however, are united, as they proceed from the animal's body. If we examine the thread with a microscope, it will be found that it is flattened on one side, and grooved along its length: from hence we may infer, that it is doubled just upon leaving the body; and that the two threads stick to each other by that gummy quality of which they are possessed. Previous to spinning its web, the silkworm seeks out some convenient place to erect its cell, without any obstruction. When it has found a leaf, or a chink fitted to its purpose, it begins to wreath its head in every direction, and fastens its thread on every side to the sides of its retreat. Though all its first essays seem perfectly confused, yet they are not altogether without design: there appears indeed, no order or contrivance in the disposal of its first threads; they are by no means laid artfully over each other, but are thrown out at random, to serve as an external shelter against rain; for Nature having appointed the animal to work upon trees in the open air, its habits remain, though it is brought up in a warm apartment.

Malpighi pretends to have observed six different layers in a single cone of silk: but what easily may be observed is, that it is composed externally of a kind of rough cotton-like substance, which is called flofs; within the thread is more distinct and even; and next the body of the aurelia, the apartment seems lined with a substance of the hardness of paper, but of a much stronger consistence. It must not be supposed, that the thread which goes to compose the cone, is rolled round, as we roll a bottom; on the contrary, it lies upon it in a very irregular manner, and winds off now from one side of the cone, and then from the other. This whole thread, if measured, will be found about three hundred yards long; and so very fine, that eight or ten of them are generally rolled off into one by the manufacturers. The cone, when completed, is in form like a pigeon's egg, and more pointed at one end than the other; at the smaller end, the head of the aurelia is generally found; and this is the place that the insect, when converted into a moth, is generally seen to burst through.

It is generally a fortnight or three weeks before the aurelia is changed into a moth; but no sooner is the winged insect completely formed, than having divested itself of its aurelia skin, it prepares to burst through its cone, or outward prison: for this purpose it extends its head towards the point of the cone, butts with its eyes, which are rough, against the lining of its cell, wears it away, and at last pushes forward, through a passage which is small at first, but which enlarges as the animal increases its efforts for emancipation; while the tattered remnants of its aurelia skin lie in confusion within the cone, like a bundle of dirty linen.

The animal, when thus set free from its double confinement, appears exhausted with fatigue, and seems produced for no other purpose but to transmit a future brood. It neither flies nor eats; the male only seeking the female, whose eggs he impregnates; and their union continues for four days, without interruption. The male dies immediately after separation from his mate; and she survives him only till she has laid her eggs, which are not hatched into worms till the ensuing spring.

However, there are few of these animals suffered to come to a state of maturity; for as their bursting through the cone destroys the silk, the manufacturers take care to kill the aurelia, by exposing it to the sun, before the moth comes to perfection. This done, they take off the flos, and throw the cones into warm water, stirring them till the first thread offers them a clue for winding all off. They generally take eight of the filken threads together; the cones still kept under water, till a proper quantity of the silk is wound off: however, they do not take all; for the latter parts grow weak, and are of a bad colour. As to the paper-like substance which remains, some stain it with a variety of colours, to make artificial flowers, others let it lie in the water, till the glutinous matter which cements it is all dissolved: it is then carded like wool, spun with a wheel, and converted into silk stuffs of an inferior kind.

C H A P. VI.

OF FLY INSECTS WITH FOUR MEMBRANACEOUS WINGS.

THE *Tenthredo* is distinguished from others of this kind, by the female having a serrated weapon or sting at the tail, and the worm from which it proceeds, has several feet. *Linnæus* distinguishes them into that clavated with feelers; that of the willow-tree; that of the poplar-tree; that of fig-wort; that of the rose; and that of the birds cherry-tree.

The black *Tenthredo* with clavated feelers, is nearly of the size of a Hornet, and the body is black and hairy, only the third, fourth, and fifth joints, are of an iron-grey. The wings are thin and transparent, and the legs black, but the feet are yellow within, and the feelers are yellow, except at the lowest joint, which is black. There are a few dark grey nerves in the wings, and the wings themselves are of a brownish tincture towards the outer edge. The worm it proceeds from, is smooth and green, only there is a black list down the back, edged with yellow; it has twenty-eight legs, and often rolls itself up.

The black *Tenthredo* with feelers that have eleven joints, is of the size of a common Fly, and the wings have several veins; there are two black spots, on the uppermost of which, that nearest the breast, is in the shape of a half-moon, but the other is round, and near it, towards the top, there is one that is white.

The yellow-legged *Tenthredo* is not much larger than a Flea, though the slender feelers are composed of ten joints. The head and breast are below,

black, and bunched, and the body is of an oval shape, of an iron-grey below, and black towards the vent: the wings are larger than the body, of a whitish colour, and without spots.

The other species of the *Tenthredo* are,

1. The black *Tenthredo* with clavated feelers, an oval body, and iron-grey wings.
2. The black *Tenthredo* with iron-grey legs, and a small horn at the vent.
3. The black *Tenthredo* with iron-grey legs, and a depressed sharp point at the vent.
4. The *Tenthredo* with feelers consisting of seven joints, with a yellow body, with the head and middle of the breast black; as also an oval spot on the wings.
5. The *Tenthredo* with feelers consisting of seven joints, and a yellow body, but black on the hinder part.
6. The *Tenthredo* with feelers consisting of seven joints, and a yellow body, and a black streak on the wings.
7. The yellow *Tenthredo* with an iron-grey spot on each wing.
8. The black *Tenthredo* with yellow legs, and yellow marks on the breast.
9. The black *Tenthredo* with short feelers.
10. The *Tenthredo* of the willow, which proceeds from a worm of a blueish-green, and has the breast and tail yellow.
11. The black *Tenthredo* with feelers that consist of seven joints, and has the edges almost, and the segments of the body, yellow.
12. The *Tenthredo* with feelers consisting of seven joints, and a black back, marked with pale, transverse, crooked lines.
13. The *Tenthredo* with feelers consisting of eighteen joints, and iron-grey legs, the hinder part being variegated with black and white.
14. The *Tenthredo* with black feelers, consisting of twelve joints, and the body is of an iron-grey below, and the legs yellow.
15. The *Tenthredo* with a brassy green breast, and the body of a gold yellow colour.
16. The brassy-blue *Tenthredo* with legs of a pale colour.
17. The black *Tenthredo* with the upper part of the breast greenish, and the legs proper for hopping.
18. The *Tenthredo* with a shining green breast, and a brown body, having a pale belt at the base, and yellow legs.
19. The *Tenthredo* with a black body, and yellow legs.
20. The black *Tenthredo* with white legs.
21. The *Tenthredo* proceeding from the gall of the willow leaf.
22. The *Tenthredo* proceeding from the gall of the beach leaf.
23. The *Tenthredo* proceeding from the gall of the *Ilex*.
24. The *Tenthredo* proceeding from the gall of ground-ivy.
25. The *Tenthredo* proceeding from the gall of the hairy hawk-weed, Linnaeus calls these insects that proceed from galls, *Cynips*, of which he makes five kinds.

The *Ichneumon Fly* is distinguished from others, by having a weapon with three forks at the tail, and are,

1. The common *Ichneumon Fly* with red legs, has a long, slender, black body, and the head, breast, feelers, and weapon at the tail, are of the same colour; but the legs are reddish, long, and slender, and the wings are

are transparent, only there is a black spot near the edge. The weapon at the tail is longer than the body, and consists of three parts like hairs, the two outermost of which are black, and the middlemost red. It is called by *Ray* the *Wasp Ichneumon*, with a slender, longish body, and three very long bristles at the tail.

2. The yellowish *Wasp Ichneumon* with large wings, is all over of the same colour, and the body is of a crooked shape, but narrow at the base; the feelers are equal to the body in length, and are composed of a great number of joints; the eyes are large and black.

5. The *Ichneumon Fly* with silver-coloured wings, has an oblong black body, only it is of a blackish red in the middle, and it has two black feelers; the wings are marked near the upper edge with a blackish spot, and the legs are reddish, and at the tail there are three long hairs, and it flies very swiftly: this is nearly like that first described.

4. The whitish *Ichneumon Fly* is all over white, except four black spots on the wings, of which the outermost are greatest, and the innermost least. It keeps its wings when sitting, erect, and has six feet, whereof the four legs are fixed to the body, and the pair before which are greater and black, take their rise close to the neck. It has two globous prominent black eyes, and two black short feelers: the body is slender, round, and as long as the breadth of a man's finger, and it has three bristles at the tail, as long as the body, which in flying it keeps of a triangular form. It appears in *May* and *June*, before and after rain. It uses the fore feet as feelers, and seems to extend them as such.

5. The *Ichneumon Fly* with silver wings and a black body, has a forked and crooked mouth, or snout, and on the forehead there are two short horns or feelers. It has four legs or feet, and the pair under the breast are slender and short; but the rest below are stronger: the tail is oblong, with two short hairs, and another in the middle, which is much longer.

6. The *Ichneumon Fly* with a black body and tail, has an oblong body, and two wings somewhat shorter than the body, with feet or legs of a saffron colour: the tail is equal in length to the rest of the body, and it is a very uncommon Fly.

7. The *Ichneumon* called the *Cotton Fly*, because it makes a web of the substance of cotton, of the size of a pigeon's egg, and is common among the grass in the autumn.

8. The *Ichneumon Fly* whose worm feeds on the flesh of the Caterpillar of the cabbage, being bred within its body.

9. The *Ichneumon Fly* with a hairy blueish black body.

10. The *Ichneumon Fly* with shelly thighs, and the feelers white in the middle.

11. The black *Ichneumon Fly* with iron-grey legs, and feelers of the same colour.

12. The black *Ichneumon Fly* with shelly legs, and feelers pale on the under part.

13. The black *Ichneumon Fly* with the hinder legs of an iron-grey, and the rest black, and the feelers white in the middle.

14. The black *Ichneumon Fly* with the legs and top of the breast white.

15. The black *Ichneumon Fly* with reddish legs, and a pale forehead.

16. The black *Ichneumon Fly* with reddish legs, only the top of those behind are black, and the feelers white in the middle.
17. The black *Ichneumon Fly* with iron-grey legs, only the hinder pair are variegated with black and white.
18. The black *Ichneumon Fly* with red legs, a white forehead, and white spots on the body.
19. The black *Ichneumon Fly* with black legs, and four white spots on each side of the body.
20. The *Ichneumon Fly* with the body and legs of an iron grey, and the middle of the feelers white.
21. The *Ichneumon Fly* with the body and legs of an iron grey, and a white ring on the feelers.
22. The yellow *Ichneumon Fly* with the extremity of the body black.
23. The *Ichneumon Fly* with an iron-grey body, only it is black at the extremity, and there is a white circle on the feelers.
24. The *Ichneumon Fly* with black feelers, and the body of an iron-grey, but black at the extremity.
25. The entirely iron-grey *Ichneumon Fly*.
26. The iron grey *Ichneumon Fly*, with the extremity of the body, and the lower part of the breast black.
27. The yellow-bodied *Ichneumon Fly*, that is yellow on the fore part, and black behind, with black joints of the legs.
28. The black and yellow *Ichneumon Fly*, having the body yellow on the fore part.
29. The black *Ichneumon Fly* with the fore part of the body of an iron-grey, and the top of the breast yellow.
30. The black *Ichneumon Fly* with brown wings, and the forward segments of the body of a reddish colour.
31. The *Ichneumon Fly* with the body of an iron-grey before, and black behind, and four white spots thereon.
32. The *Ichneumon Fly* with the forepart of the body of an iron-grey, and the hinder part black, with five yellow spots thereon, and the feelers whitish on one side.
33. The *Ichneumon Fly* with the fore part of the body of an iron-grey, and the hinder black, without spots; but the feelers are marked with a white circle.
34. The *Ichneumon Fly* with the fore part of the body of an iron-grey, and the hinder black, with yellowish incisures, and a white circle on the feelers.
35. The red and black *Ichneumon Fly*, the middle of the body and the fore legs being reddish, and the lower of those behind white.
36. The black *Ichneumon Fly* with the second and third segments of the body yellow, as well as the legs.
37. The black *Ichneumon Fly* with white wings, and a double transverse line on each.
38. The long slender-bodied *Ichneumon Fly* with bristly feelers as long as the body, and clavated legs.
39. The brassy green elegant *Ichneumon Fly* with black spiral feelers.
40. The great black *Ichneumon Fly* with the extremity of the body red.

C H A P. VII.

OF INSECTS OF THE BEE, OR WASP KIND, THAT HAVE STINGS IN THEIR TAILS.

TO give a complete history of this insect in a few pages, which some have exhausted volumes in describing, and whose nature and properties still continue in dispute, is impossible. It will be sufficient to give a general idea of the animal's operations; which, though they have been studied for more than two thousand years, are still but incompletely known. The account given us by Reaumur is sufficiently minute, and, if true, sufficiently wonderful: but I find many of the facts which he relates, doubted by those who are most conversant with bees; and some of them actually declared not to have a real existence in nature.

It is unhappy, therefore, for those whose method demands an history of bees, that they are unfurnished with those materials which have induced so many observers to contradict so great a naturalist. His life was spent in the contemplation; and it requires an equal share of attention, to prove the error of his discoveries. Without entering, therefore, into the dispute, I will take him for my guide; and just mention, as I go along, those particulars in which succeeding observers have begun to think him erroneous. Which of the two are right, time only can discover; for my part I have only heard one side, for as yet none have been so bold as openly to oppose Reaumur's delightful researches.

There are three different kinds of bees in every hive. First, the labouring bees, which make up the far greatest number, and are thought to be neither male nor female, but merely born for the purposes of labour, and continuing the breed, by supplying the young with provision, while yet in their helpless state. The second sort are the drones; they are of a darker colour, longer, and more thick by one third than the former: they are supposed to be the males; and there is not above a hundred of them, in a hive of seven or eight thousand bees. The third sort is much larger than either of the former, and still fewer in number: some assert, that there is not above one in every swarm; but this later observers affirm not to be true, there being sometimes five or six in the same hive. These are called queen bees, and are said to lay all the eggs from which the whole swarm is hatched in a season.

In examining the structure of the common working bee, the first remarkable part that offers is the trunk, which serves to extract the honey from flowers. It is not formed, like that of other flies, in the manner of a tube, by which the fluid is to be sucked up; but like a besom, to sweep, or a tongue, to lick it away. The animal is furnished also with teeth, which serve it in making wax. This substance is gathered from flowers, like honey; it consists of that dust or farina which contribute to the fecundation of plants, and is moulded into wax by the little animal, at leisure. Every bee, when it leaves the hive to collect this precious store, enters into the cup of the flower, particularly such as seem charged with the greatest quantities of this yellow farina. As the animal's body is covered over with hair, it rolls itself within the flower, and soon becomes quite covered with the dust, which it soon after brushes off with its two hind legs, and kneads into two little balls. In the

thighs of the hind legs there are two cavities, edged with hair; and into these, as into a basket, the animal sticks its pellets. Thus employed, the bee flies from flower to flower, increasing its store, and adding to its stock of wax; until the ball, upon each thigh, becomes as big as a grain of pepper: by this time, having got a sufficient load, it returns, making the best of its way to the hive.

The belly of the bee is divided into six rings, which sometimes shorten the body, by slipping one over the other. It contains within it, beside the intestines, the honey-bag, the venom bag, and the sting. The honey bag is as transparent as crystal, containing the honey that the bee has brushed from the flowers; of which the greater part is carried to the hive, and poured into the cells of the honey-comb; while the remainder serves for the bee's own nourishment: for, during summer, it never touches what has been laid up for the winter. The sting, which serves to defend this little animal from its enemies, is composed of three parts; the sheath, and two darts, which are extremely small and penetrating. Both the darts have several small points or barbs, like those of a fish-hook, which renders the sting more painful, and makes the darts rankle in the wound. Still, however, this instrument would be very slight, did not the bee poison the wound. The sheath, which has a sharp point, makes the first impression; which is followed by that of the darts, and then the venomous liquor is poured in. The sheath sometimes sticks so fast in the wound, that the animal is obliged to leave it behind; by which the bee soon after dies, and the wound is considerably inflamed. It might at first appear well for mankind, if the bee were without its sting; but, upon recollection, it will be found, that the little animal would then have too many rivals in sharing its labours. An hundred other lazy animals, fond of honey, and hating labour, would intrude upon the sweets of the hive; and the treasure would be carried off, for want of armed guardians to protect it.

From examining the bee singly, we now come to consider it in society, as an animal not only subject to laws, but active, vigilant, laborious, and disinterested. All its provisions are laid up for the community; and all its arts in building a cell, designed for the benefit of posterity. The substance with which bees build their cells is wax; which is fashioned into convenient apartments for themselves and their young. When they begin to work in their hives, they divide themselves into four companies: one of which roves in the fields in search of materials; another employs itself in laying out the bottom and partitions of their cells; a third is employed in making the inside smooth from the corners and angles; and the fourth company bring food for the rest, or relieve those who return with their respective burthens. But they are not kept constant to one employment; they often change the tasks assigned them: those that have been at work, being permitted to go abroad; and those that have been in the fields already, take their places. They seem even to have signs, by which they understand each other; for when any of them wants food, it bends down its trunk to the bee from whom it is expected, which then opens its honey-bag, and lets some drops fall into the other's mouth, which is at that time opened to receive it. Their diligence and labour is so great, that, in a day's time, they are able to make cells, which lie upon each other, numerous enough to contain three thousand bees.

If we examine their cells, they will be found formed in the exactest proportion. It was said by Pappus, an ancient geometrician, that, of all other figures, hexagons were the most convenient; for, when placed touching each other, the most convenient room would be given, and the smallest lost. The cells of the bees are perfect hexagons: these, in every honeycomb, are double, opening on either side, and closed at the bottom. The bottoms are composed of little triangular panes, which, when united together, terminate in a point, and lie exactly upon the extremities of other panes of the same shape, in opposite cells. These lodgings have spaces, like streets, between them, large enough to give the bees a free passage in and out; and yet narrow enough to preserve the necessary heat. The mouth of every cell is defended by a border, which makes the door a little less than the inside of the cell, which serves to strengthen the whole. These cells serve for different purposes: for laying up their young; for their wax, which in winter becomes a part of their food; and for their honey, which makes their principal subsistence.

It is well known that the habitation of bees ought to be very close; and what their hives want, from the negligence or unskilfulness of man, these animals supply by their own industry: so that it is their principal care, when first hived, to stop up all the crannies. For this purpose they make use of a resinous gum, which is more tenacious than wax, and differs greatly from it. This the ancients called *Propolis*: it will grow considerably hard in June; though it will in some measure soften by heat; and is often found different in consistence, colour, and smell. It has generally an agreeable aromatic odour when it is warmed; and by some it is considered as a most grateful perfume. When the bees begin to work with it, it is soft, but it acquires a firmer consistence every day; till at length it assumes a brown colour, and becomes much harder than wax. The bees carry it on their hinder legs; and some think it is met with on the birch, the willow, and poplar. However it is procured, it is certain that they plaster the inside of their hives with this composition.

If examined through a glass hive, from the hurry the whole swarm is in, the whole at first appears like anarchy and confusion: but the spectator soon finds every animal diligently employed, and following one pursuit with a settled purpose. Their teeth are the instruments by which they model and fashion their various buildings, and give them such symmetry and perfection. They begin at the top of the hive; and several of them work at a time, at the cells which have two faces. If they are stinted with regard to time, they give the new cells but half the depth which they ought to have; leaving them imperfect, till they have sketched out the number of cells necessary for the present occasion. The construction of their combs, cost them a great deal of labour: they are made by insensible additions; and not cast at once in a mould, as some are apt to imagine. There seems no end of their shaping, finishing, and turning them neatly up. The cells for their young are most carefully formed; those designed for lodging the drones, are larger than the rest; and that for the queen-bee, the largest of all. The cells in which the young brood are lodged, serve at different times for containing honey; and this proceeds from an obvious cause: every worm, before it is transformed into an aurelia, hangs its old skin on the partitions

titions of its cell; and thus, while it strengthens the wall, diminishes the capacity of its late apartment. The same cell in a single summer, is often tenanted by three or four worms in succession; and the next season by three or four more. Each worm takes particular care to fortify the pannels of its cell, by hanging up its spoils there: thus, the partitions being lined, six or eight deep, become at last too narrow for a new brood, and are converted into store-houses, for honey.

Those cells where nothing but honey is deposited, are much deeper than the rest. When the harvest of honey is so plentiful that they have not sufficient room for it, they either lengthen their combs, or build more; which are much longer than the former. Sometimes they work at three combs at a time; for when there are three work-houses, more bees may be thus employed, without embarrassing each other.

But honey, as was before observed, is not the only food upon which these animals subsist. The meal of flowers, of which their wax is formed, is one of their most favourite repasts. This is a diet which they live upon during the summer; and of which they lay up a large winter provision. The wax of which their combs are made, is no more than this meal digested, and wrought into a paste. When the flowers upon which bees generally feed, are not fully blown, and this meal or dust is not offered in sufficient quantities, the bees pinch the tops of the stamina in which it is contained, with their teeth; and thus anticipate the progress of vegetation. In April and May, the bees are busy, from morning to evening, in gathering this meal; but when the weather becomes too hot in the midst of summer, they work only in the morning.

The bee is furnished with a stomach for its wax, as well as its honey. In the former of the two, their powder is altered, digested, and concocted into real wax: and is thus ejected by the same passage by which it was swallowed. Every comb, newly made, is white: but it becomes yellow as it grows old, and almost black when kept too long in the hive. Beside the wax thus digested, there is a large portion of the powder kneaded up for food in every hive, and kept in separate cells, for winter provision. This is called by the country people, bee-bread; and contributes to the health and strength of the animal during winter. Those who rear bees, may rob them of their honey, and feed them during the winter, with treacle; but no proper substitute has yet been found for the bee-bread; and without it, the animals become consumptive and die.

As for the honey, it is extracted from that part of the flower called the nectareum. From the mouth this delicious fluid passes into the gullet; and then into the first stomach, or honey-bag, which, when filled, appears like an oblong bladder. Children, that live in country places, are well acquainted with this bladder; and destroy many bees to come at their store of honey. When a bee has sufficiently filled its first stomach, it returns back to the hive, where it disgorges the honey into one of the cells. It often happens that the bee delivers its store to some other, at the mouth of the hive, and flies off for a fresh supply. Some honey-combs are always left open for common use; but many others are stopped up, till there is a necessity of opening them: Each

Each of these are covered carefully with wax; so close, that the covers seem to be made at the very instant the fluid is deposited within them.

Having thus given a cursory description of the insect, individually considered, and of the habitation it forms, we next come to its social habits and institutions: and, in considering this little animal attentively, after the necessary precautions for the immediate preservation of the community, its second care is turned to the continuance of posterity. How numerous soever the multitude of bees may appear in one swarm, yet they all owe their original to a single parent, which is called the *Queen-Bee*. It is indeed surprising that a single insect shall, in one summer, give birth to above twenty thousand young: but, upon opening her body, the wonder will cease; as the number of eggs appearing, at one time, amounts to five thousand. This animal, whose existence is of such importance to her subjects, may easily be distinguished from the rest, by her size, and the shape of her body. On her safety depends the whole welfare of the commonwealth; and the attentions paid her by all the rest of the swarm, evidently shew the dependence her subjects have upon her security. If this insect be carefully observed, she will be seen at times attended with a numerous retinue, marching from cell to cell, plunging the extremity of her body into many of them, and leaving a small egg in each.

The bees which generally compose her train, are thought to be males, which serve to impregnate her by turns. These are larger and blacker than the common bees; without stings, and without industry. They seem formed only to transmit a posterity; and to attend the queen, whenever she thinks proper to issue from the secret retreats of the hive, where she most usually resides. Upon the union of these two kinds depends all expectations of a future progeny; for the working bees are of no sex, and only labour for another offspring: yet such is their attention to their queen, that if she happens to die, they will leave off working, and take no farther care of posterity. If, however, another queen is in this state of universal despair presented them, they immediately acknowledge her for sovereign, and once more diligently apply to their labour. It must be observed, however, that all this fertility of the queen-bee, and the great attentions paid to her by the rest, are controverted by more recent observers. They assert, that the common bees are parents themselves; that they deposit their eggs in the cells which they have prepared; that the females are impregnated by the males, and bring forth a progeny, which is wholly their own.

However, to go on with their history, as delivered us by Mr Reaumur—When the queen-bee has deposited the number of eggs necessary in the cells, the working bees undertake the care of the rising posterity. They are seen to leave off their usual employments; to construct proper receptacles for eggs; or to complete those that are already formed. They purposely build little cells, extremely solid, for the young; in which they employ a great deal of wax: those designed for lodging the males, as was already observed, are larger than the rest; and those for the queen-bees the largest of all. There is usually but one egg deposited in every cell; but when the fecundity of the queen is such, that it exceeds the number of cells already prepared, there are sometimes three or four eggs crowded together in the same apartment. But this is an inconvenience that the working bees will by no means suffer.

They

They seem sensible that, two young ones, stuffed up in the same cell, when they grow larger, will but embarrass, and at last destroy each other: they therefore take care to leave a cell to every egg; and remove, or destroy the rest.

The single egg that is left remaining, is fixed to the bottom of the cell, and touches it but in a single point. A day or two after it is deposited, the worm is excluded from the shell of the egg, having the appearance of a maggot rolled up in a ring, and lying softly on a bed of a whitish coloured jelly; upon which also the little animal begins to feed. In the mean time, the instant it appears, the working bees attend it with the most anxious and parental tenderness; they furnish it every hour with a supply of this whitish substance, on which it feeds and lies; and watch the cell with unremitting care. They are nurses that have a greater affection for the offspring of others, than many parents have for their own children. They are constant in visiting each cell, and seeing that nothing is wanting; preparing the white mixture, which is nothing but a composition of honey and wax, in their own bowels, with which they feed them. Thus attended, and plentifully fed, the worm, in less than six days time, comes to its full growth, and no longer accepts the food offered it. When the bees perceive that it has no further occasion for feeding, they perform the last offices of tenderness, and shut the little animal up in its cell; walling up the mouth of its apartment with wax; there they leave the worm to itself; having secured it from every external injury.

The worm is no sooner left inclosed, but, from a state of inaction, it begins to labour, extending and shortening its body; and by this means lining the walls of its apartment with a silken tapestry, which it spins in the manner of caterpillars, before they undergo their last transformation. When their cell is thus prepared, the animal is soon after transformed into an aurelia; but differing from that of the common caterpillar, as it exhibits not only the legs, but the wings of the future bee, in its present state of inactivity. Thus, in about twenty, or one and twenty days after the egg was laid, the bee is completely formed, and fitted to undergo the fatigues of its state. When all its parts have acquired their proper strength and consistence, the young animal opens its prison, by piercing with its teeth the waxen door that confines it. When just freed from its cell, it is as yet moist, and incommoded with the spoils of its former situation; but the officious bees are soon seen to flock round it, and to lick it clean on all sides with their trunks; while another band, with equal assiduity, are observed to feed it with honey: others again begin immediately to cleanse the cell that has been just left; to carry the ordure out of the hive, and to fit the place for a new inhabitant. The young bee soon repays their care, by its industry; for as soon as ever its external parts become dry, it discovers its natural appetites for labour, and industriously begins the task, which it pursues unremittingly through life. The toil of man is irksome to him, and he earns his subsistence with pain; but this little animal seems happy in its pursuits, and finds delight in all its employments.

When just freed from the cell, and properly equipped by its fellow bees for duty, it at once issues from the hive, and instructed only by Nature, goes in quest of flowers, chooses only those that yield it a supply, rejects such as are barren of honey, or have been already drained

by other adventurers ; and when loaded, is never at a loss to find its way back to the common habitation. After this first sally, it begins to gather the mealy powder, that lies on every flower, which is afterwards converted into wax ; and with this, the very first day, it returns with two large balls stuck to its thighs.

When bees first begin to break their prisons, there are generally above an hundred excluded in one day. Thus, in the space of a few weeks, the number of the inhabitants in one hive, of moderate size, becomes so great, that there is no place to contain the new comers ; and they are scarcely excluded from the cell, when they are obliged, by the old bees, to sally forth in quest of new habitations. In other words, the hive begins to swarm, and the new progeny prepares for exile.

While there is room enough in the hive, the bees remain quietly together ; it is necessity alone that compels the separation. Sometimes, indeed, the young brood, with graceless obstinacy, refuse to depart, and even venture to resist their progenitors. The young ones are known by being browner than the old, with whiter hair ; the old ones are of a lighter colour, with red hair. The two armies are therefore easily distinguishable, and dreadful battles are often seen to ensue. But the victory almost ever terminates with strict poetical justice in favour of the veterans, and the rebellious offspring are driven off, not without loss and mutilation.

In different countries, the swarms make their appearance at different times of the year, and there are several signs previous to this intended migration. The night before, an unusual buzzing is heard in the hive ; in the morning, though the weather be soft and inviting, they seem not to obey the call, being intent on more important meditations within. All labour is discontinued in the hive, every bee is either employed in forcing, or reluctantly yielding a submission ; at length, after some noise and tumult, a queen bee is chosen to guard rather than conduct the young colony to other habitations, and then they are marshalled without any apparent conductor. In less than a minute they leave their native abode, and forming a cloud round their protectress, they set off, without seeming to know the place of their destination : *The world before them, where to choose their place of rest.* The usual time of swarming is from ten in the morning to three in the afternoon, when the sun shines bright, and invites them to seek their fortunes. They flutter for a while in the air, like flakes of snow, and sometimes undertake a distant journey, but more frequently are contented with some neighbouring asylum ; the branch of a tree, a chimney-top, or some other exposed situation. It is, indeed, remarkable, that all those animals, of whatever kind, that have long been under the protection of man, seem to lose a part of their natural sagacity, in providing for themselves. The rabbit, when domesticated, forgets to dig holes, the hen to build a nest, and the bee to seek a shelter, that shall protect it from the inclemencies of the winter. In those countries, where the bees are wild, and unprotected by man, they are always sure to build their waxen cells in the hollow of a tree ; but with us, they seem improvident in their choice, and the first green branch that stops their flight, seems to be thought sufficient for their abode through winter. However, it does not appear, that the queen chooses

the place where they are to alight, for many of the stragglers; who seem to be pleased with a particular branch, go and settle upon it; others are seen to succeed, and at last, the queen herself, when she finds a sufficient number there before her, goes to make it the place of her head quarters. When the queen is settled, the rest of the swarm soon follow; and, in about a quarter of an hour, the whole body seem to be at ease. It sometimes is found, that there are two or three queens to a swarm, and the colony is divided into parties; but it most usually happens, that one of these is more considerable than the other, and the bees by degrees, desert the weakest, to take shelter under the most powerful protector. The deserted queen does not long survive this defeat; she takes refuge under the new monarch, and is soon destroyed by her jealous rival. Till this cruel execution is performed, the bees never go out to work; and if there should be a queen bee belonging to the new colony left in the old hive, she always undergoes the fate of the former. However, it must be observed, that the bees never sacrifice any of their queens, when the hive is full of wax and honey; for there is at that time, no danger in maintaining a plurality of breeders.

When the swarm is thus conducted to a place of rest, and the policy of government is settled, the bees soon resume their former labours. The making cells, storing them with honey, impregnating the queen, making proper cells for the reception of the rising progeny, and protecting them from external danger, employ their unceasing industry. But soon after, and towards the latter end of summer, when the colony is sufficiently stored with inhabitants, a most cruel policy ensues. The drone bees, which are (as has been said) generally in a hive, to the number of an hundred, are marked for slaughter. These, which had hitherto led a life of indolence and pleasure, whose only employment was in impregnating the queen, and rioting upon the labours of the hive, without aiding in the general toil, now share the fate of most voluptuaries, and fall a sacrifice to the general resentment of society.

The working bees, in a body, declare war against them; and in two or three days time, the ground all round the hive is covered with their dead bodies. Nay, the working bees will kill such drones, as are yet in the worm state, in the cell, and eject their bodies from the hive, among the general carnage.

When a hive sends out several swarms in the year, the first is always the best, and the most numerous. These, having the whole summer before them, have the more time for making wax and honey, and consequently their labours are the most valuable to the proprietor. Although the swarm chiefly consists of the youngest bees, yet it is often found that bees of all ages compose the multitude of emigrants, and it often happens, that bees of all ages are seen remaining behind. The number of them is always more considerable than that of some populous cities, for sometimes upwards of forty thousand are found in a single hive. So large a body may well be supposed to work with great expedition; and in fact, in less than twenty-four hours, they will make combs above twenty inches long, and seven or eight broad. Sometimes they will half fill their hives with wax, in less than five days. In the first fifteen days, they are always found to make more wax than they do afterwards during the rest of the year.

Such are the out-lines of the natural history of these animals, as usually found in our own country. How they are treated, so as to produce the greatest quantity of honey, belongs rather to the rural economist, than the natural historian; volumes have been written on the subject, and still more remains equally curious and new. One thing, however, it may be proper to observe that a farm, or country, may be over-stocked with bees, as with any other sort of animal; for a certain number of hives, always require a certain number of flowers to subsist on. When the flowers near home are rifled, then are these industrious insects seen taking more extensive ranges, but their abilities may be over taxed; and if they are obliged, in quest of honey, to go too far from home, they are over-wearied in the pursuit, they are devoured by birds, or beat down by the winds and rain.

From a knowledge of this, in some parts of France and Piedmont, they have contrived, as I have often seen, a kind of floating bee-houſe.

They have on board one barge, threescore or an hundred bee-hives, well defended from the inclemency of an accidental storm; and with these the owners suffer themselves to float gently down the river. As the bees are continually choosing their flowery pasture along the banks of the stream, they are furnished with sweets before unrifled; and thus a single floating bee-houſe, yields the proprietor a considerable income. Why a method similar to this has never been adopted in England, where we have more gentle rivers, and more flowery banks, than in any other part of the world, I know not; certainly it might be turned to advantage, and yield the posſessor a ſecure, though perhaps a moderate income.

Having mentioned the industry of these admirable insects, it will be proper to ſay ſomething of the effects of their labour, of that wax and honey, which are turned by man to ſuch various uses. Bees gather two kinds of wax, one coarse and the other fine. The coarser sort is bitter, and with this, which is called *propolis*, they stop up all the holes and crevices of their hives. It is of a more resinous nature than the fine wax, and is conſequently better qualified to refiſt the moisture of the ſeafon, and preserve the works warm and dry within. The fine wax is as neceſſary to the animal's paſteurization as the honey itſelf. With this they make their lodgings, with this they cover the cells of their young, and in this they lay up their magazines of honey. This is made, as has been alreaſdy obſerved, from the dust of flowers, which is carefully kneaded by the little insect, then swallowed, and having undergone a kind of diſteſſion, is formed into the cells, which anſwers ſuch a variety of purpoſes. To collect this, the animal rolls itſelf in the flower it would rob, and thus takes up the vegetable dust with the hair of its body. Then carefully brushing it into a lump, with its fore paws it thrusts the composition into two cavities behind the thighs, which are made like ſpoons to receive the wax, and the hair that lines them, ſerves to keep it from falling.

As of wax, there are alſo two kinds of honey: The white and the yellow. The white is taken without fire from the honey-combs. The yellow is extracted by heat, and ſqueezed through bags, in a press. The beſt honey is new, thick, and granulated, of a clear transparent white colour, of a ſoft and aromatic ſmell, and of a ſweet and lively taste. Honey made in mountainous countries, is preferable to that of the valley. The honey made in the ſpring, is more highly eſteemed,

than that gathered in summer, which last is still more valuable, than that of autumn, when the flowers begin to fade and lose their fragrance.

The bees are nearly alike in all parts of the world, yet there are differences worthy our notice. In Guadaloupe, the bee is less by one half, than the European, and more black and round. They have no sting, and make their cells in hollow trees; where, if the hole they meet with is too large, they form a sort of waxen house, of the shape of a pear, and in this they lodge and store their honey, and lay their eggs. They lay up their honey in waxen vessels, of the size of a pigeon's egg, of a black or deep violet colour: and these are so joined together, that there is no space left between them. The honey never congeals, but is fluid, of the consistence of oil, and the colour of amber. Resembling these, there are found little black bees, without a sting, in all the tropical climates; and though these countries are replete with bees, like our own, yet those form the most useful and laborious tribe in that part of the world. The honey they produce, is neither so unpalatable, nor so surfeiting as ours; and the wax is so soft, that it is only used for medicinal purposes, it being never found hard enough to form into candles, as in Europe.

Of insects, that receive the name of bees, among us, there are several; which, however, differ very widely from that industrious, social race we have been just describing. The HUMBLE BEE is the largest of all this tribe, being as large as the first joint of one's middle finger. These are seen in every field, and perched on every flower. They build their nest in holes in the ground, of dry leaves, mixed with wax and wool, defended with moss from the weather. Each humble bee makes a separate cell about the size of a small nutmeg, which is round and hollow, containing the honey in a bag. Several of these cells are joined together, in such a manner, that the whole appears like a cluster of grapes. The females, which have the appearance of wasps, are very few, and their eggs are laid in cells, which the rest soon cover over with wax. It is uncertain whether they have a queen or not; but there is one much larger than the rest, without wings and without hair, and all over black, like polished ebony. This goes and views all the works, from time to time, and enters into the cell, as if it wanted to see whether every thing was done right: In the morning, the young humble bees are very idle, and seem not at all inclined to labour, till one of the largest, about seven o'clock, thrusts half its body from a hole, designed for that purpose, and seated on the top of the nest, beats its wings for twenty minutes successively, buzzing the whole time, till the whole colony is put in motion. The humble bees gather honey, as well as the common bees; but it is neither so fine, nor so good, nor the wax so clean, or so capable of fusion.

Besides the bees already mentioned, there are various kinds among us, that have much the appearance of honey-makers, and yet make only wax. The WOOD BEE is seen in every garden. It is rather larger than the common queen bee; its body of a blueish black, which is smooth and shining. It begins to appear at the approach of spring, and is seen flying near walls exposed to a sunny aspect. This bee makes its nest in some piece of wood, which it contrives to scoop and hollow for its purpose. This, however is never done in trees that are standing,

standing, for the wood it makes choice of is half rotten. The holes are not made directly forward, but turning to one side, and have an opening sufficient to admit one's middle finger; from whence runs the inner apartment, generally twelve or fifteen inches long. The instruments used in boaring these cavities, are their teeth; the cavity is usually branched into three or four apartments; and in each of these, they lay their eggs, to the number of ten or twelve, each separate and distinct from the rest: The egg is involved in a sort of paste, which serves at once for the young animal's protection and nourishment. The grown bees, however, feed upon small insects, particularly a louse, of a reddish brown colour, of the size of a small pin's head.

Mason Bees make their cells with a sort of mortar, made of earth, which they build against a wall that is exposed to the sun. The mortar, which at first is soft, soon becomes as hard as stone, and in this their eggs are laid. Each nest contains seven or eight cells, an egg in every cell, placed regularly one over the other. If the nest remains unhurt, or wants but little repairs they make use of them the year ensuing: and thus they often serve three or four years successively. From the strength of their houses, one would think these bees in perfect security, yet none are more exposed than they. A worm with very strong teeth, is often found to bore into their little fortifications, and devour their young.

The *Ground Bee* builds its nest in the earth, wherein they make round holes, five or six inches deep; the mouth being narrow, and only just sufficient to admit the little inhabitant. It is amusing enough, to observe the patience and assiduity with which they labour. They carry out all the earth, grain by grain, to the mouth of the hole, where it forms a little hillock, an Alps compared to the power of the artist by which it is raised. Sometimes the walks of a garden are found undermined by their labours; some of the holes running directly downward, others horizontally beneath the surface. They lay up in these cavities provisions for their young, which consist of a paste that has the appearance of corn, and is of a sweetish taste.

The *Leaf-cutting Bees* make their nest and lay their eggs among bits of leaves very artificially placed in holes in the earth, of about the length of a tooth-pick case. They make the bits of leaves of a roundish form, and with them line the inside of their habitations. This tapestry is still further lined by a reddish kind of paste, somewhat sweet or acid. These bees are of various kinds; those that build their nests with chesnut-leaves are as big as drones, but those of the rose-tree are smaller than the common bee.

The *Wall Bees* are so called, because they make their nests in walls of a kind of silky membrane with which they fill up the vacuities between the small stones which form the sides of their habitation. Their apartment consists of several cells placed end to end, each in the shape of a woman's thimble. Though the web which lines this habitation is thick and warm, yet it is transparent and of a whitish colour. This substance is supposed to be spun from the animal's body. The male and females are of a size, but the former are without a sting. To these varieties of the bee kind might be added several others which are all different in nature, of which hereafter.

However similar many insects may be in appearance, this does not imply a similitude in their history. The bee and the wasp resemble each other very strongly, yet, in examining their manner and their duration, they differ very widely; the bee labours to lay up honey, and lives to enjoy the fruits of its industry; the wasp appears equally assiduous, but only works for posterity, as the habitation is scarcely completed when the inhabitant dies.

The wasp is well known to be a winged insect with a sting. To be longer in proportion to its bulk than the bee, to be marked with bright yellow circles round its body, and to be the most swift and active insect of all the fly kind. On each side of the mouth this animal is furnished with a long tooth, notched like a saw, and with these it is enable to cut any substance, not omitting meat itself, and to carry it to its nest. Wasps live like bees in community, and sometimes ten or twelve thousand are found inhabiting a single nest.

Of all other insects the wasp is the most fierce, voracious, and most dangerous, when enraged. They are seen wherever flesh is cutting up, gorging themselves with the spoil, and then flying to their nests with their reeking prey. They make war also on every other fly, and the spider himself dreads their approaches.

Every community among bees is composed of females or queens, drones or males, and neutral or working bees. Wasps have similar occupation; the two first are for propagating the species, the last for nursing, defending, and supporting the rising progeny. Among bees, however, there is seldom above a queen or two in an hive; among wasps there are above two or three hundred.

As soon as the summer begins to invigorate the insect tribes, the wasps are the most of the number, and diligently employed either in providing provisions for their nest, if already made, or in making one, if the former habitation be too small to receive the increasing community. The nest is one of the most curious objects in natural history, and contrived almost as artificially as that of the bees themselves. Their principal care is to seek out an hole that has been begun by some other animal, a field mouse, a rat, or a mole, to build their nests in. They sometimes build upon the plain, where they are sure of the dryness of their situation, but most commonly on the side of a bank to avoid the rain or water that would otherwise annoy them. When they have chosen a proper place they go to work with wonderful assiduity. Their first labour is to enlarge and widen the hole, taking away the earth and carrying it off to some distance. They are perfectly formed for labour, being furnished with a trunk above their mouths, two saws on each side which play to the right and left against each other, and six strong muscular legs to support them. They cut the earth into small parcels with their saws, and carry it out with their legs or paws. This is the work of some days; and at length the outline of their habitation is formed, making a cavity of about a foot and an half every way. While some are working in this manner, others are roving the fields to seek out materials for their building. To prevent the earth from falling down and crushing their rising city into ruin, they make a sort of roof with their gluey substance, to which they begin to fix the rudiments of their building, working from the top downwards, as if they were hanging a bell, which, however, at length they close up at the bottom.

tom. The materials with which they build their nests are bits of wood and glue. The wood they get where they can from the rails and posts which they meet with in the fields and elsewhere. These they saw and divide into a multitude of small fibres, of which they take up little bundles in their claws, letting fall upon them a few drops of gluey matter with which their bodies are provided, by the help of which they knead the whole composition into a paste, which serves them in their future building. When they have returned with this to their nest, they stick their load of paste on that part where they make their walls and partitions; they tread it close with their feet, and trowel it with their trunks, still going backwards as they work. Having repeated this operation three or four times, the composition is at length flattened out until it becomes a small leaf of a grey colour, much finer than paper, and of a pretty firm texture. This done the same wasp returns to the field to collect a second load of paste, repeating the same several times, placing layer upon layer, and strengthening every partition in proportion to the wants or convenience of the general fabric. Other working wasps come quickly after to repeat the same operation laying more leaves upon the former, till at length, after much toil, they have finished the large roof which is to secure them from the tumbling in of the earth. This dome being finished, they make another entrance to their habitation, designed either for letting in the warmth of the sun, or for escaping in case one door be invaded by plunderers. Certain however it is, that by one of these they always enter, by the other they sally forth to their toil; each hole being so small that they can pass but one at a time. The walls being thus composed, and the whole somewhat of the shape of a pear, they labour at their cells, which they compose of the same paper like substance that goes to the formation of the outside works. Their combs differ from those of bees, not less in the composition than the position which they are always seen to obtain. The honey comb of the bees is edgeways with respect to the hive; that of the wasp is flat, and the mouth of every cell opens downward. Thus is their habitation, contrived story above story, supported by several rows of pillars which give firmness to the whole building, while the upper story is flat-roofed, and as smooth as the pavement of a room, laid with squares of marble. The wasps can freely walk upon these stories between the pillars to do whatever their wants require. The pillars are very hard and compact, being larger at each end than in the middle, not much unlike the columns of a building. All the cells of the nest are only destined for the reception of the young, being replete with neither wax nor honey.

Each cell is like that of the bee, hexagonal; but they are of two sorts, the one larger for the production of the male and female wasps, the other less for the reception of the working part of the community. When the females are impregnated by the males, they lay their eggs, one in each cell, and stick it in with a kind of gummy matter to prevent its falling out. From this egg proceeds the insect in its worm-state, of which the old ones are extremely careful, feeding it from time to time till it becomes large, and entirely fills up its cell. But the wasp community differs from that of the bee in this; that among the latter the working bees take the parental duties upon them, whereas among the wasps the females alone are permitted to feed their young, and to nurse their

their rising progeny. For this purpose the female waits with great patience till the working wasps have brought in their provisions, which she takes from them, and cuts into pieces. She then goes with great composure from cell to cell, and feeds every young one with her mouth. When the young worms have come to a certain size they leave off eating, and begin to spin a very fine filk, fixing the first end to the entrance of the cell, then turning their heads, first on one side, then on the other, they fix the thread, to different parts, and thus they make a sort of a door which serves to close up the mouth of the cell. After this they divest themselves of their skins after the usual mode of transformation, the aurelia by degrees begins to emancipate itself from its shell; by little and little it thrusts out its legs and wings, and insensibly acquires the colour and shape of its parent.

The wasp thus formed, and prepared for depredation, becomes a bold, troublesome, and dangerous insect: there are no dangers which it will not encounter in pursuit of its prey, and nothing seems to satiate its gluttony. Though it can gather no honey of its own, no animal is more fond of sweets. For this purpose it will pursue the bee and the humble bee, destroy them with its sting, and then plunder them of their honey-bag, with which it flies triumphantly loaded to its nest to regale its young. Wasps are ever fond of making their nests in the neighbourhood of bees, merely to have an opportunity of robbing their hives, and feasting on the spoil. Yet the bees are not found always patiently submissive to their tyranny, but fierce battles, are sometimes seen to ensue, in which the bees make up by conduct and numbers what they want in personal prowess. When there is no honey to be had, they seek for the best and sweetest fruits, and they are never mistaken in their choice. From the garden they fly to the city, to the grocers shops, and butchers shambles. They will sometimes carry off bits of flesh half as big as themselves, with which they fly to their nests for the nourishment of their brood. Those who cannot drive them away, lay for them a piece of ox's liver, which being without fibres, they prefer to other flesh; and whenever they are found, all other flies are seen to desert the place immediately. Such is the dread with which these little animals impress all the rest of the insect tribes, which they seize and devour without mercy, that they vanish at their approach. Wherever they fly, like the eagle or the falcon, they form a desert in the air around them. In this manner the summer is passed in plundering the neighbourhood, and rearing up their young; every day adds to their numbers; and from their strength, agility, and indiscriminate appetite for every kind of provision, were they as long lived as the bee, they would soon swarm upon the face of Nature, and become the most noxious plague of man: but providentially their lives are measured to their mischief, and they live but a single season.

While the summer heats continue, they are bold, voracious, and enterprising; but as the sun withdraws, it seems to rob them of their courage and activity. In proportion as the cold increases, they are seen to become more domestic; they seldom leave the nest, they make but short adventures from home, they flutter about in the noon-day heats, and soon after return chilled and feeble.

As their calamities increase, new passions soon begin to take place; the care for posterity no longer continues, and as the parents are no longer

longer able to provide their growing progeny a supply, they take the barbarous resolution of sacrificing them all to the necessity of the times. In this manner, like a garrison upon short allowance, all the useless hands are destroyed; the young worms, which a little before they fed and protected with so much assiduity, are now butchered and dragged from their cells. As the cold increases they no longer find sufficient warmth in their nests, which grow hateful to them, and they fly to seek it in the corners of houses, and places that receive an artificial heat. But the winter is still insupportable; and, before the new year begins, they wither and die; the working wasps first, the males soon following, and many of the females suffering in the general calamity. In every nest, however, one or two females survive the winter, and having been impregnated by the male during the preceding season, she begins in spring to lay her eggs in a little hole of her own contrivance. This bundle of eggs, which is clustered together like grapes, soon produces two worms which the female takes proper precaution to defend and supply, and these when hatched soon give assistance to the female, who is employed in hatching two more; these also gathering strength, extricate themselves out of the web that enclosed them, and become likewise assistants to their mother; fifteen days after, two more make their appearance; thus is the community every day increasing, while the female lays in every cell, first a male and then a female. These soon after become breeders in turn, till, from a single female, ten thousand wasps are seen produced before the month of June. After the female has thus produced her progeny, which are distributed in different districts, they assemble from all parts, in the middle of summer, and provide for themselves the large and commodious habitation, which has been described above.

Such is the history of the social wasp; but, as among bees, so also among these insects, there are various tribes that live in solitude: these lay their eggs in a hole for the purpose, and the parent dies long before the birth of its offspring. In the principal species of the SOLITARY WASPS, the insect is smaller than the working wasp of the social kind. The filament, by which the corselet is joined to the body, is longer and more distinctly seen, and the whole colour of the insect is blacker than in the ordinary kinds. But it is not their figure, but the manners of this extraordinary insect that claim our principal regard.

From the end of May to the beginning of July, this wasp is seen most diligently employed. The whole purpose of its life seems to be in contriving and fitting up a commodious apartment for its young one, which is not to succeed it till the year ensuing. For this end it is employed, with unwearyed assiduity in boring a hole into the finest earth some inches deep, but not much wider than the diameter of its own body. This is but a gallery leading to a wider apartment destined for the convenient lodgment of its young. As it always chuses a gravelly soil to work in, and where the earth is almost as hard as stone itself; the digging and hollowing this apartment is an enterprise of no small labour: for effecting its operations, this insect is furnished with two-teeth, which are strong and firm, but not sufficiently hard to penetrate the substance through which it is resolved to make its way. In order therefore to soften that earth which it is unable to pierce, it is furnished with a gummy liquor which it emits upon the place, and which renders

ders it more easily separable from the rest, and the whole becoming a kind of soft paste is removed to the mouth of the habitation. The animal's provision of liquor in these operations is however soon exhausted; and it is then seen either taking up water from some neighbouring flower or stream in order to supply the deficiency.

At length, after much toil, a hole some inches deep is formed, at the bottom of which is a large cavity; and to this no other hostile insect would venture to find its way, from the length and the narrowness of the defile through which it would be obliged to pass. In this the solitary wasp lays its egg, which is destined to continue the species; there the nascent animal is to continue for above nine months, unattended and immured, and at first appearance the most helpless insect of the creation. But when we come to examine, new wonders offer, no other insect can boast so copiously luxurious a provision, or such confirmed security.

As soon as the mother wasp has deposited her egg at the bottom of the hole, her next care is to furnish it with a supply of provisions, which may be offered to the young insect as soon as it leaves the egg. To this end she procures a number of little green worms, generally from eight to twelve, and these are to serve as food for the young one the instant it awakens into life. When this supply is regularly arranged and laid in, the old one then, with as much assiduity as it before worked out its hole, now closes the mouth of the passage; and thus leaving its young one immured in perfect security, and in a copious supply of animal food, she dies satisfied with having provided for a future progeny.

When the young one leaves the egg it is scarcely visible, and is seen immured among a number of insects, infinitely larger than itself, ranged in proper order around it, which, however give it no manner of apprehension. Whether the parent, when she laid in the insect provision, contrived to disable the worms from resistance, or whether they were at first incapable of any, is not known. Certain it is, that the young glutton feasts upon the living spoil without any controul; his game lies at his hand, and he devours one after the other as the calls of appetite incite him. The life of the young animal is therefore spent in the most luxurious manner, till its whole stock of worms is exhausted, and then the time of its transformation begins to approach; and then spinning a silken web, it continues fixed in its cell till the sun calls it from its dark abode the ensuing summer.

The wasps of Europe are very mischievous, yet they are innocence itself when compared to those of the tropical climates, where all the insect tribes are not only numerous, but large, voracious, and formidable. Those of the West Indies are thicker, and twice as long as the common bee; they are of a grey colour, striped with yellow, and armed with a very dangerous sting. They make their cells in the manner of a honey-comb, in which the young ones are hatched and bred. They generally hang their nests by threads, composed of the same substance with the cells, to the branches of trees, and the caves of houses. They are seen every where in great abundance, descending like fruit, particularly pears, of which shape they are, and as large as one's head. The inside is divided into three round stories, full of cells, each hexagonal, like those of an honey-comb. In some of the islands these insects

sects are so very numerous, that their nests are stuck up in this manner, scarce two feet asunder, and the inhabitants are in continual apprehension from their accidental resentment. It sometimes happens, that no precautions can prevent their attacks, and the pains of their sting is almost insupportable. Those who have felt it think it more terrible than even that of a scorpion ; the whole visage swells, and the features are so disfigured, that a person is scarcely known by his most intimate acquaintance.

C H A P. VIII.

A MORE PARTICULAR ACCOUNT OF BEES, AND THE FRENCH METHOD OF MANAGING THEM.

BEES being the most profitable insects yet known, except silk Worms, the reader will not be displeased to have a more particular account of them, and their management, by way of supplement to what has been said before. And if any thing be repeated, that has been mentioned before, it will be only done to render this account more complete and uniform.

Bees in ancient times were all wild, and they inhabited the vast forests of *Poland*, *Russia*, and other northern countries, lodging in hollow trees, holes in the rocks, and in the gound. They are insects of a wonderful kind, and which naturalists have treated of in different ages ; insomuch that some pretend there have been philosophers, who spent the greatest part of their time, in studying their nature. However in this age, they are better known by much than formerly ; *Swammerdam* in particular, has made curious researches into their nature, as well as *Maraldi*, and *Reaumur*, two ingenious members of the royal academy of sciences.

We now are very certain, that in every hive, there are three distinct kinds of Bees ; the most numerous of which are the common sort, whose busines is to gather the honey and wax. These may be called the labouring Bees, and according to the most curious observers, they are neither male nor female. Another sort are the drones, and these are males. Of the third sort, there is generally but one, which was commonly called the king, but is now known to be the queen, for it is a female, and is always the mother of a numerous posterity.

With regard to the external parts of the common Bees, the most remarkable are the head, the corset or breast, and the body or belly. In the head there are the eyes, placed on each side, and two feelers, composed of several joints, and two teeth or pinchers, and the trunk or snout, which is a kind of tongue, enclosed in two cases, and of a substance resembling that of a horn, or scales, with a large mouth, seated at the root of the tongue. The corset is joined to the head by a short neck, and on it there are four wings above, and six legs or feet below, of which the two hindmost are longer than the rest, and externally in the middle, there is a hollowness, in the shape of a spoon, bordered

bordered with fifteen hairs. The lowest part of each leg, which may be called the foot, is composed of five joints, by which they are enabled to use them as hands, and they terminate in a kind of brush: the body properly so called, or belly, is joined to the corslet by a sort of thread, and is composed of six scaly rings: the whole body of the Bee, appears hairy to the naked eye; and as for the rest, they differ a little from these, in size and colour.

With regard to the inward parts, upon examination, there appears a vesicle of the size of a small pea, and when it is full of honey, it is transparent: the sting is placed at the extremity of the body, and is one sixth of an inch in length, terminating in a fine point. Towards the base of the sting, there is a bladder, remarkable for its transparence and solidity, which is oblong like an olive, and full of a very clear fluid, terminating by a kind of excretory vessel, designed to conduct the poison of the reservoir into the sting, which enters and passes out in great swiftness, by the means of certain muscles.

The *Drone* may be distinguished from the working Bee, not only by the trunk, the teeth, and the eyes, but by the corslet, which is more hairy than that of the common Bee, and the rings of the belly are more smooth. Besides the hairs of the brushes of the hind feet, are more crowded together, and shorter: the body is generally larger and longer, by about a third part, and the head in particular, is more round and more full of hair. Add to this, that at certain seasons, there are two fleshy horns behind, about a third part as long as the body, and sometimes longer; and between these two horns, there is a fleshy substance, which rises upon the hinder part of the body, and is crooked like a bow: the inward parts are also different, for he has no sting, and within the body, there is little else but thick, white, crooked vessels, that are pretty solid, and contain a milky fluid.

The *Queen* is longer, but not so thick as the *Drone*, and the wings are very short, in proportion to the length of the body; for they scarcely cover it half way: the trunk is much shorter, and more slender, than that of the working Bee; but longer and thicker than that of the *Drone*: the corslet is brown, and the rings of the belly are of a deep chesnut colour: the sting is much larger than that of the common Bee; but instead of being straight, turns back a little towards the belly; the bladder of venom is proportionable thereto. Her eggs are distributed into two ovaries, one of which is on the right side, and the other on the left. Each ovary is an assemblage of vessels, all which terminate in a common canal, and which are full of eggs, at the time of breeding.

In the management of *Bees*, great care must be taken to provide them a proper lodging: the hives designed for this purpose, are of different forms, and different materials, in different countries; but they are generally a sort of baskets, nearly of a conical figure: those that are most skilful in the management of these insects, affirm, that the hives ought to be made of plaited rye straw, because they are most proper to defend the Bees against the severity of the winter cold, and the scorching heat of summer. Some plaster them over with a mortar, or with ashes, mixed with cow dung; by which means no rain can get into the hive; for all the crannies will be stopped up, by which it might enter.

The hives ought always to be placed where the sun may shine upon them the greatest part of the day, and consequently they should never be

be exposed to the north wind. Likewise they will be best to be so placed, that the sun may shine upon them early in the morning, as also late in the evening. However it must be observed, that though the sun is very advantageous to Bees, yet there are times, when his beams are too scorching, which will render the hives too hot, so as to disturb the Bees, and to melt their wax. Upon this account, it will be best to place them under a cover or roof, to preserve them from the extreme heat of the sun, and from the rain. But where this cannot easily be done, they may be thatched or covered with straw, which will have the same effect.

Glass hives are a new invention, and were designed to enable persons to see what was doing in the inside. However they are needless in the winter season, because when there is a frost, the Bees are so benumbed, that any one may examine their hives, by laying them on one side, or even turning them upside down. Then the Bees may be seen heaped together, and lying as close to each other as possible. They generally keep in the lower part of the cakes of wax, or at most about the middle of the hive. But as soon as it thaws, and especially if the sun shines, so as to render the hive warm, they then are roused out of their lethargy. Hence it appears, that heat is absolutely necessary for their preservation; and this they endeavour to encrease, by their motion, and the agitation of their wings. Likewise the more numerous the bees are in a hive, the warmer they are. However when their activity is returned, they are then under a necessity of taking nourishment, and consequently they have recourse to their provisions; for then they begin to feed upon the lower combs. Hence the milder the winter is, the more honey they consume; and they are sometimes in danger of a famine, and to die of hunger, before the flowry season returns. Thus a very severe winter, and one that is too mild, are equally dangerous.

It is commonly said, that the ashes of a fig tree, is capable of bringing dead Bees to life; but this is a mistake, for those Bees which are thought to be dead, because they are motionless, are not really so; though it must be owned, that in extreme cold weather, any person may be deceived. At this time a handful may be taken, without the danger of being stung; but if they are put upon warm ashes, or near a gentle fire, they will immediately show that they are alive.

Besides cold, hunger, and old age, Bees are said to be subject to fluxes, which sometimes bring on a mortality among them; and they are also subject to other diseases; and those Bees that are brought into any close place, such as a green-house, during the winter, are more subject to diseases, than others, that are left in the gardens, with an aperture, by which fresh air may enter, and through which they are at liberty to fly out when they please, and when the weather is fine. However the middle practice is the best, which is to leave those hives in the open air, that are well stocked with Bees, and to place those in the green house, which are thin of Bees. It is the opinion of *Reaumur*, that it will be the best to put these last into tubs, open at the top, and to fill up the empty spaces, between the sides of the tub and the hive, with fine hay, short straw, sand, or dried earth; but they must be defended from the rain, by a covering, placed at a proper distance over it. This he thinks is a good expedient to preserve

them from the effects of cold, and much better than to place them in a green house. The charge will be little, because the same tubs will serve for a great number of years. Large wicker baskets may be also made use of in the same manner.

The design of the Stings of Bees, is not to hurt mankind, but to defend them against their enemies which are very numerous. Hornets and Wasps will tear open the bellies of Bees, to suck the contents. Spiders also are enemies, but they are not able to do so much harm; as for Ants, they want nothing but the honey; but Lizards, Frogs, and Toads, will eat the Bees entirely up, when they can catch them. There is also a sort of Moths, that will get into their cells, and will penetrate into a great number of them, to feed upon the wax, of which they are extremely fond. Old Bees are subject to a kind of Lice, which are not found upon the young; however they do not appear to be greatly molested by them. Field Mice and Birds, are greater enemies to Bees, than any thing else; insomuch that in one night, when they are benumbed in the winter season, a single field Mouse is able to destroy a hive that is very well stocked. *Reaumur* observes, that these animals generally eat nothing but the heads and the breasts. They will serve Birds much in the same manner, for the young Larks have been found near the nests, that have nothing wanting but the head and the neck. It is also said, that among Birds, that those called Bee eaters, Swallows, and Titmice, feed greatly upon Bees; but the Bird that does most mischief among them, and destroys more than all the rest put together, is the Sparrow. They swallow them like grains of corn, and they have been seen to carry three Bees at a time, to feed their young with, that is one in their bills, and two others in their claws.

Those that are accustomed to take care of Bees, may go among them very safely, provided they do not anger them; but if they do, they must expect the reward of their rashness. They generally attempt to sting people in their faces, and when any one is stung, if the Bee is forced away too soon, it always leaves its sting behind, with its appendages; but then the Bee will live but a short time after it. The sting is generally more painful in summer than in winter; for this depends upon the quantity of the venom, and the vigour of the Bee: besides there are persons which are more affected with the stings of Bees than others. Generally speaking, the sting is followed with an itching, an inflammation, a swelling, and a sharp pain; and if it happens to be near the eyes, the eye-lids will sometimes close up for several days. Authors that have wrote upon this subject, pretend to give several remedies against the stinging of Bees; but *Reaumur* has tried them all, with little success; however he thinks that the herb called arse mart, has proved better than any thing else, when bruised in a mortar, and applied thereto. But the best way is to take out the sting as soon as possible, and then apply a little water, or vinegar, to the wound, as soon as possible, and then the pain will vanish; yet it has been observed, that it has sometimes returned again, with as much violence as before.

Some have pretended, that there are certain smells, which give great offence to Bees; and that they are fondest of every thing that is clean and pure; but this is a mistake, for they always like standing dirty

dirty water, better than that which is quite limpid. But smoak will cause them to get at a distance from it, and if they cannot readily, it benumbs them, and makes them lye as if they were dead ; this is the method some make use of, to get part of the honey out of the hive. This operation is performed at different times, in different countries ; but the best is in the morning, after the Bees have been rendered less active by the coldness of the night, and then it will be almost needless to smoak them. However, in a warm season, when flowers are plenty, they may be made to pass out of a hive that is full of wax and honey, into another that is quite empty ; but then the brood will be lost ; that is, the eggs, the nymphs, and the worms ready to be changed into nymphs. When the honey is taken away, it is but reasonable, and even necessary, to leave the Bees about half for their own use.

In some places, when the summer is dry, and in consequence thereof, the fields are less fruitful, then it is very difficult for the Bees to gather a sufficient quantity of wax ; but in those countries that are full of meadows, that are well watered, and produce a succession of different flowers ; or even if there are woods, which by their shade, preserve the moistness and coolness of the air, and by that means cause the vegetation of a great number of plants, in the hottest part of summer, then the Bees will find every thing in plenty, necessary for their use.

It was formerly a custom of the *Egyptians*, to carry the hives up the river *Nile* in boats, that the Bees might enjoy the benefit of the flowers that grew upon the banks ; thus they removed them from place to place, that they might always enjoy the benefit of fresh flowers. The nations that live near the banks of the river *Po*, manage their Bees much in the same manner, as the ancient *Egyptians* ; and the same practice has been recommended in *France* ; but whether it has ever been done or not, is uncertain. *Columella* acquaints us, that the *Greeks* were accustomed every year, to remove the hives from *Achaia* into *Attica* ; and the same thing is done at this very day, in the dutchy of *Juliers*, a district of *Westphalia*, in *Germany*. One person in particular, in the territory, called *Gatonis* in *France*, has been at the pains of removing his hives, after the harvest of *Sainfoin*, into the plains of *Beauce*, where the melilot abounds, and then into *Salogne*, where it is well known the Bees may enjoy the advantage of Buck-wheat, till towards the end of *September*, for so long that plant retains its flowers. However this practice cannot be very agreeable to the Bees, because their being carried in carts, disturbs them more, than if they were in boats upon the water.

Authors have given different accounts of the length of the life of Bees ; but they have generally maintained, that they may live several years ; that is as long as a hive retains plenty of inhabitants ; but this is a bad reason. Some affirm that Bees will live six or seven years, and others upwards of twelve. Others again pretend to be certain, that a third part in every hive, dies in autumn, and as many in the spring ; for which reason they conclude, that they cannot live above a single year. It is pretty certain, that the Bees of each hive, are renewed every year, or in two years time at most.

It is generally acknowledged, that the habitation of Bees ought to be very close, and therefore it is their principal care, at first when they are

are hived, to stop up all the crannies. They make use of a sort of resinous gum, which is more tenaceous than wax, and differs greatly from it. This the French call *propolis*. It will grow considerably hard in *June*, though it will always grow soft with heat, and it varies in consistence, colour, and smell. It has generally an aromatic, agreeable smell, when it is warmed, insomuch that some place it in the rank of perfumes. The outward colour is of a reddish brown; but the inward more yellowish, and nearer the colour of wax. When the Bees begin to work with it, it is soft; but it acquires a firmer consistence every day; till at length it becomes harder than wax. The Bees carry it on their hinder legs, and some think it is met with on poplar, birch, and willow trees; but there are others that will supply them with the same. It is much harder for them to get it from hence, than the powder which is upon the stamina of plants, and more difficult to manage, the Bees make use of the same substance to cover the sticks laid crossways, which help to support the combs; and often they plaster a great part of the inner sides of their hives therewith.

It is wonderful to consider how the Bees build their combs, wherein the cells are of so regular a form, and applied so ingeniously, one against another. Every thing seems to be disposed with so much symmetry, and so well finished, that at first sight, one may be tempted to think, that they are the principal workmanship of these industrious insects. All the cells are hexagons, that is, they have six equal sides; and this figure, not only takes up the least room, but is the most capacious.

It is no easy matter to see them at work, except by the assistance of a glass hive. They are always ready to assist each other, in laying the foundation of some new comb, or enlarging the old, though a spectator might conclude from the hurry that they are in, that there was nothing but confusion among them. However it is easy to perceive, that their teeth are the instruments, by which they model and fashion their combs. They begin at the bottom of their building, and several of them work at a time, at the cells, which have two faces. But if they are stinted with regard to time, they give the new cells but half the depth which they ought to have, leaving them imperfect, and put off finishing them, till they have sketched out the number of cells, which are necessary for the present time. The construction of their combs, costs them a great deal of labour, for they are not able to make them in molds, as at first some might think they were. They are all busied in erecting, shaping, and polishing the cells that are unfinished; and the use they make of them, is to lodge their honey, and to deposit their brood therein, for there the eggs increase and grow, till they are transformed into Bees. But the cells designed for the worms to change into drones, ought to be larger than the rest; and for that reason, they make some with greater diameters than others. The cells of the brood, at different times, serve for the honey-comb; however those that were designed for the honey only, are much deeper than the rest. When the harvest of honey is so plentiful, that they have no sufficient room for it, they either lengthen their combs, or build more, which are much longer than the former.

Sometimes they work at three combs at a time; for when there are three workhouses, more Bees may be employed at a time, without embarrassing each other, and they can perform their business more readily

ly. The combs are generally parallel to each other, and they are slightly fastened to the top of the hive. There is always a space between two combs, which are like streets, that will only admit two at a time, a breast. Though the combs consist of very thin leaves of wax, yet when they are full of honey, they become heavy. The Bees have a method of connecting their combs to the sides of their hive, for which reason, those that make them, should place small sticks across each other, to serve as supports to the combs that are to be built, this will save the Bees a great deal of labour.

The substance wherewith they make their combs, is gathered from flowers; but not from every sort indifferently; for it is only the stamens of flowers, that yield proper materials for making their wax; for they find none ready made. It is very common to see Bees sitting upon flowers, with their bodies all over powder, which they could have got nowhere else. Sometimes they are so full of it, that they become quite yellow, and might be mistaken, for another insect. However they take care to clean themselves with the brushes of their feet; and to make the powder into two small balls, which they place in the two triangular cavities of their hinder legs. Sometimes these balls are as large as a grain of pepper, a little flattened. When the flowers are not fully blown, the Bees pinch the tops of the stamens with their teeth, wherein they know the grains of dust are enclosed; and by this means they force them open. Some of these balls are yellow, others red, others of a whitish yellow, and others again green. In *April* and *May*, the Bees are busy from morning to evening, in gathering the wax; but when the weather becomes hot, in *June* and *July*, they work only in the morning, till about ten o'clock, because then the powder of the stamens, having been moistened with the dew, or with the fluid that they transpire, is of a more proper consistence, than at other times, to be moulded into a mass.

It is said that the second stomach is the organ, by which this powder is altered, digested, and connected into real wax; and is thrown out, through the same passage that it went in. It is with this sort of paste, that they build their combs, and when it is dry, it becomes the substance, named Bees wax. Every comb newly made is white; but they become yellowish as they grow old, and the very oldest of all, become almost black. But all these do not furnish wax equally white, as is well known to those, whose business it is to blanch it.

However as it is necessary for Bees to make a provision of rough wax, there is in every hive, a pretty large portion of the combs, whose cells are filled with nothing but wax; and these are like so many little magazines, where the Bees go to deposit their little balls, one after another, while other Bees take care to knead them, press them, and place them in order. The Bees sometimes come out of their hives at 4 o'clock in the morning, and continue labouring till 8 in the evening. They fly backwards and forwards, four or five times in a day, and sometimes more, for this depends on the length of their journeys, and the plenty of flowers.

It is observable that the Bees extract but a small quantity of real wax out of the powder which they gather; because a great part of the materials of wax, serves to feed them; it is also remarkable, that the drones never employ themselves in making wax, all their nourishment being

being honey. With regard to the honey, it is but lately taken notice of, that there are vessels in flowers full of a sweet fluid, to which authors have given the name of nectarium, and it is to these that the Bees resort, to gather the liquor, which afterwards becomes honey. To this purpose, they make use of their trunks, and with these the Bees conduct the fluid to their mouths, causing it to run along the upper part of their trunks. The powder of the stamina, is not the only nourishment of Bees, for it is very well known, they do not make honey on purpose for us. The sweet fluid falls from the oesophagus or gullet, into the first stomach, which while it is filled with honey, is in shape like an oblong bladder. Children that live in country places, are well acquainted with this bladder; and they even seek for it in the bodies of the Bees, and more especially in those of humble Bees, to suck out the honey. When a Bee has sufficiently filled her first stomach it returns back to the hive, where it throws up the honey into a cell. There is reason to believe, that the honey does not return out of the body unchanged; because the first stomach is capable of contraction, in the same manner as that of ruminating animals. It often happens, that the Bee, instead of flying back to the hive, goes back to the places where the other Bees are busy in their several employments, and offers them honey, perhaps to hinder them from leaving off their work, to go in search of food. Some of the honey combs are always left open for common use, but many others are stopped up, till there is a necessity of opening them; each of these are covered carefully with wax, so close, that the covers seem to be made at the same time. This practice tends to preserve the honey in the same degree of fluidity, as they design it should have.

The ancients were of opinion, that the generation of Bees, was occasioned by putrified substances, and not in a manner analogous to that of other animals. Some who have built their faith too much on what *Virgil* has said in the fourth book of his *Georgics*, in the fable of the Shepherd *Aristaeus*; and have taken a bull of two years old, have stopped up his nostrils, and afterwards killed him, and so left him to putrify. But this procedure was so far from producing swarms of Bees, that they only met with thousands of maggots, and a dreadful stench. Others have published variety of fictitious stories, to acquaint the world in what manner these insects generated.

During the greater part of the year, there is but one female in every hive, which may readily be distinguished from other Bees, by the shape of her body; but it is somewhat difficult to find her out. The males, who may be seen by hundreds, spend almost their whole lives in company with the female. For this reason, they are seldom out of the hive, but they lie idle therein, doing nothing at all, but feeding upon the honey, which the working Bees have gathered. Nevertheless they are not useless, for though they do not work, they are absolutely necessary for the production of other Bees.

The Bee, called the Queen, is most prodigiously fertile, for she alone produces all the rest of the Bees in the same hive. Insomuch that there is no connection that can be greater, than between the rest of the Bees and her. It is certain, that all the Bees leave off working, and take no farther care of futurity, after the death of the queen. She is full of a prodigious number of eggs; and it is for the sake of these, that the Bees set themselves to work. Besides, if any other female Bee

be put in among them, she is immediately acknowledged for queen. The life of all the rest, is nothing in comparison of her's. They do her all manner of services, and pay her all the homage, that is due from subjects to a sovereign; for she never goes abroad, without a numerous guard; they keep her body clean with their trunks, and follow her wherever she goes. When after her death the Bees continue in a state of perfect idleness; if another queen is presented them, they immediately apply to their labour again. In short the life of the rest of the Bees depends upon that of the queen, for in a few days after her death, they will all suffer themselves to die with hunger.

The working Bees are always very provident in providing cells for the young; and they will leave off their common employment, to construct proper receptacles for the eggs. They build purposely, little cells, of a roundish oblong shape, and extremely solid, and they employ great plenty of wax in this work. This position is greatly different from that of the other combs; these sort of Bees, know, or at least appear to know what number of eggs the queen lays in a year, from whence proceed other females, that give birth to several thousands of the working Bees, and several hundred males. Sometimes they do not lay but three or four at first, and sometimes none at all; but in this last case, the hives produce no swarms. The fecundity of this Bee is such, that in seven or eight weeks time, she will produce 10 or 12000 Bees and upwards. Generally speaking, she lays but one egg in each cell, because it would not be sufficient to hatch any more. In two or three days time, according to the heat of the weather, the egg will appear hatched at the bottom of the cell. It has the appearance of a kind of a maggot, which is always white, and placed in the same attitude, that is, rolled up like a ring, lying softly in a bed of a kind of gelly, of a whitish colour; and this is what the brood feeds upon. The common bees are a kind of nurses to the brood, and have greater affection for it, than the hired nurses among mankind. They take care in visiting each cell, and in examining whether any thing is wanting. They are fed with honey and wax, prepared in the bodies of the Bees; and in less than six days time, the worm comes to its full growth. When the Bees perceive that the worms have no farther occasion for feeding, they shut them up in their lodgings, and wall them up, if the expression may be allowed, with wax. Then the worm continuing in a state of perfect rest, begins to grow larger, and lines the walls of the cell with silken tapestry, which they spin in the same manner as Caterpillars, before they undergo their last transformation. But it is observable, that the Bees bring them more nourishment than they are able to consume. Before they spin their covering, they eat up all their provision of gelly, leaving the bottom of the cell clean and dry. In a day's time, or longer, they obtain their full growth, and then they cast off their skins, which served them in their worm state, and become an *Aurelia Nymph*. The worms that produce Drones, are of the same size as those of the working Bees. These last take care of them with the same application; and it may well be imagined, that they are not less attentive to those which are to be metamorphosed into female Bees; for it has been observed, that they supply them with nourishment, in greater profusion.

When all parts of the *Aurelia* have acquired the confidence proper to the parts of the Bee ; then that which is to appear, opens its prison, by piercing with its teeth, the waxy cover about its middle. The Bees which perceive that which is coming to light, flock about it, and seem to express their joy, that they are going to be metamorphosed ; and this they discover by their good offices. Two or three of them lick and clean all its sides with their trunks, and some of them feed it with honey. Others again begin immediately to cleanse the cell that has been just left ; and carry away the filth out of the hive. As soon as the external parts of the young Bee become dry, it begins to discover what employment it is to have during life ; for it immediately proceeds out of the hive, and goes in quest of flowers ; and is not at all at a loss to find its way back to the common habitation. After this first sally, it begins sometimes to gather the powder of the stamens ; and *Maraldi* assures us, that he has seen one of these, on the very day it came into the world, return back with two large balls of this substance. When the Bees first begin to break their prisons, there is generally above 100 of them in a day ; insomuch that in the space of a few weeks, the number of the inhabitants becomes so great, that the hive cannot contain them ; and then they begin to sally out in swarms. Young Bees are the brownest, with white hair ; and the old are of a lighter colour, with red hair. The swarm is made on purpose to seek out a new settlement ; and that the head of it, is the queen ; for one of these is sufficient to conduct the whole swarm. About five or six days after the birth of a female Bee, she is ready to lay her eggs, and consequently is in a condition to place herself at the head of those that are disposed to follow her.

In different countries, the swarms make their sally at different times ; and in the same country, they leave the hives sometimes sooner, and sometimes later. There are several signs, which foretel when the Bees are going to swarm ; but the most certain is, when the working Bees do not fly into the fields, in their accustomed numbers ; though the weather seems to invite them. The time is from 10 in the morning, till 3 in the afternoon, that the swarms leave the hives. When the sun shines bright, especially upon the hive, it invites the Bees to seek their fortune ; for the heat has a great influence in this procedure, and renders the number more considerable. In less than a minute, all those that are to compose the swarm, leave the hive and flutter in the air, like flakes of snow. However it does not appear that the queen chuses the place where they are to alight ; for several of the Bees, which are pleased with a particular branch of a tree, go and settle thereon ; and they are followed by many others, as well as the queen herself ; but she does not join them, till there are a great number together. When it comes to be pretty large, then it soon is highly increased ; insomuch that in about a quarter of an hour, they all seem to be at ease. Sometimes when they leave the hive, they rise so high in the air, that they get out of sight ; and to make them come down, they throw handfuls of sand or dust after them. Some suppose that the Bees take the grains of sand for drops of rain ; but it is the common method to beat brass kettles and pans, as soon as ever they perceive the swarm ready to fly. It is pretended, that the tinkling of these

these vessels, is taken for thunder, and that it obliges the Bees to seek a proper place for a retreat. When the Bees are fixed, they cause them to enter into a hive, rubbed with the leaves of balm, mixed with a little honey. When they make their first sally, there may be several females, insomuch that a swarm has sometimes two queens, and is even divided into two bands. But as it commonly happens, that one of these is more considerable than the other, the Bees who are fond of a large company, the smallest band dwindles by little and little, by their going to join the largest. Thus a swarm may have two queens, and sometimes more; but they do not continue long, for the supernumerary queens are always killed in the hive, where the swarm settles; and till this cruel execution is performed, the Bees never fly abroad to work. If there should be any female Bees left in the old hive, that did not go out with the swarm, they always undergo the same fate; that is, those that have been newly transformed. Hence it follows, that there is never more than one queen in the same hive. However it must be observed, that the Bees, never sacrifice any of the females, when their hives are full of honey and wax; and it is given as a reason, that there is no danger at that time, to maintain a plurality of breeders.

Bees in some sense, observe the same rules as Wasps; for when the time is come, that the males are no longer necessary, the working Bees declare war against them; and in two or three days time, they make a dreadful havock amongst them; insomuch, that the ground all round the hive, is strewed with dead bodies; nay they will even kill those that are yet in their worm state, or of that of an Aurelia. This butchery is performed at different times; for in some hives, it happens in *June*, and in others not till *July* or *August*.

When the hive sends out several swarms in a year; that which first proceeds therefrom, is always the best, and most numerous; and then likewise they are able to lay up the greatest plenty of honey and wax. It is remarkable, that a swarm, always consists of Bees of all ages, and likewise there continues in the hive Bees of all ages. The number of them is always more considerable, than that of the inhabitants of many large cities; for sometimes they are upwards of 40,000. It is wonderful to consider the activity of the Bees, when they first enter an empty hive; for often in less than twenty-four hours time, they will make combs, above twenty inches long, and seven or eight broad; and sometimes they will half fill their hives with wax in five days; insomuch, that a swarm will make more wax in the first fifteen days, than they do afterwards all the rest of the year. When a swarm is considerable, and appears early, they sometimes send out another the same year.

In consideration of the care and trouble that people are at, in taking care of the preservation and multiplication of Bees, it appears reasonable that they should partake with them, of the fruit of their labour. But it is a kind of a barbarity to destroy all the Bees with sulphur, or otherwise to get all the wax or honey; and yet we see this is often done, by those who make a trade of dealing in such commodities. In some countries, this practice is forbid, and particularly in *Tuscany*. With proper care, a great number of hives might be saved every year, and there cannot be too many in those places that greatly abound in flowers. It must be acknowledged, that honey is not in such great request as formerly, before the making of sugar was found out. How-

ever it is of great use still in many respects; and the consumption of wax is greater than ever. In *France*, a good swarm in two years, will yield two pounds and a half of wax, and near thirty pounds of honey; and therefore under a good regulation, a considerable profit may be made of them. But Bees are still more beneficial, in countries that are covered with flowers the greatest part of the year, especially in hot countries, such as *Spain*, *Peru*, and *Mexico*, where tallow is always too soft to make candles with.

In *Muscovy*, and in *America*, there is sometimes found in the trunks of old trees, a sort of black wax, in round bits, of the size of a nutmeg. This is produced by small Bees, who make their combs in these hollow trunks, whose honey is of a citron colour, and of a very agreeable taste. This wax, when heated, has a smell like balm, but it is seldom to be met with in *France*. The *Americans* make candles with the wax, and likewise small vessels, which they make use of to gather the balsam of *Tolu*.

With regard to the medicinal qualities of Bees, it is well known, that they are diuretic, when reduced to powder, and the dose is half a dram in a morning, incorporated with the extract of juniper berries; or it may be given in a glass of diuretic wine. The same powder strowed upon the head, will make the hair grow, and it will become thicker than before.

There are two sorts of honey, that is, the white and the yellow. The white is taken without fire from the honey-combs. These they break soon after they are made, and lay them upon hurdles or mats of osier, or on linen cloth, fastened at the four corners to as many posts, and then an excellent white honey will fall from the combs, and grow hard in a short time. Afterwards they put it into glazed earthen pots, this they call virgin honey. Some press this honey out, but then it is not so agreeable, for it will taste of the wax. The best sort of this honey, that the *French* are acquainted with, is that of *Languedoc*; and they call it honey of *Narbonne*. It should be new, thick, granulated, of a clear transparent white colour, of a soft, and somewhat aromatic smell, and of a sweet and lively taste. If it is very pure, it is almost as hard as sugar candy; and that which renders it different from all others, are the many aromatic flowers, that grow in those parts; and from which the Bees gather their honey. It is always observable, that the honey made in mountainous countries, where the sun has a great power, is more fine, and more spirituous, than that which is produced in low grounds, not well warmed by the sun.

Yellow honey is made from all sorts of honey-combs, that is, old as well as new; and even of those from whence the virgin honey has been extracted. They break the combs, and heat them with a little water in basons, or pots, keeping them continually stirring; then they put them into bags of thin linen-cloth, and these they put in a press, to squeeze out the honey. The wax stays behind in the bags, though there is always a little of it passes through with the honey; for when it is distilled, there is always found small bits of wax that rise with the spirit. Yellow wax should always be of a good consistence, of a fine yellow, and well tasted; the *French* take that to be the best, that is made in *Camphagne*, because the soil is dry in that country, and the flowers aromatic. It contains a great deal of essential or acid salt, and

phlegm, and a little oil and earth. The white honey contains the same principles, but not quite so much salt.

The ancients, as has been already taken notice of, made greater use of honey, than we do at present, because sugar was not then so common; but in some cases, it is still preferred; for it is more purging in glysters, and cleanses wounds better, upon which account it is mixed with digestives. It is a greater preservative of the compositions into which it enters, than sugar, on account of its clamminess; and for this reason, it is made use of in venice treacle, and mithridate. It also deserves to be preferred, because it contains the most essential substance of flowers, and may be said to contain the quintessence of aromatic plants. Honey taken in substance, is pectoral, laxative, and deterfusive, and is good in many disorders of the lungs, occasioned by a gross phlegm. It also loosens the belly, and is made use of in clysters. The whitest honey is best for inward use, as the yellow is for outward. Some use it as an aliment, and then it is easy of digestion, and supplies the blood with a new balsam of life; however it is not good for dry bilious constitutions. We are told in the *German ephemerides*, that a young country girl, having eaten a great deal of honey, became so intemperate with it, that she slept a whole day, and talked a little idly the day following.

The most common preparations of honey for drink are mead, and methegelin; these in some countries are in high esteem. The common hydromel is made with boiling an ounce and a half of honey, with a quart of spring water, taking off the scum; after which it is strained through a cloth, and may be used as common drink. This is good against coughs in old people, and when any person cannot bring up phlegm without difficulty. Some direct it against internal ulcers, because they suppose it is an enemy to putrefaction.

Vinous hydromel is made by mixing four pounds of virgin honey, with ten quarts of spring water, and boiling it till about a third is consumed, or till an egg will swim thereon. Then it is to be poured into a cask, which must be exposed to the heat of the sun, or in a stove for forty days; or till the liquor will ferment no longer, shaking it from time to time. Then the cask must be stopped up, and put in a cellar, to be kept for use. This strengthens the stomach, and is very well tasted.

There is kept in the shops, other preparations of honey, namely, simple oxymel, and oxymel of squills. The first is made by mixing two parts of good honey, with one of white wine vinegar, and boiling it to the consistence of a syrup. The dose is half a spoonful, and it is thought to be good to incide thick viscous humours, that adhere to the bronchia of the lungs, in a moist asthma. Oxymel of squills has the same virtues, but much stronger.

Honey-water, made by the chymists, has an agreeable smell, and a sharpish taste; and it is looked upon as cordial, pectoral, and aperitive. Some wash their heads with it, to make their hair grow, or apply it every day with a sponge. Spirit of honey is opening, and the oil is good against rotten bones.

Externally, wine mixed with honey, is very good to cleanse ulcers, and assist in forming a cicatrice. Honey-water is good to clear the sight; and take off the spots of the cornea. Some make use of the mare of Bees, which is nothing else than what remains after the wax

of the combs is pressed out, to cure the pleurisy. For this purpose, they mix it with vinegar, and lay it between two clean linen cloths; after which they apply it as a poultice, to the pained part, and sprinkle it with vinegar from time to time, without taking it off. It is also good in cold and oedematous swellings, which are hard to be resolved. Farriers also make use of it, against bruises in horses.

Bees wax is composed of two parts, namely, a great deal of phlegm, which keeps an acid dissolved, and an oil. It should be new, hard, compact, a little glutinous to the touch, of a fine yellow colour, and of a pleasant smell, somewhat like that of honey; but it should have no taste at all. Virgin wax, is that which is made without the help of fire; and is nothing but a preparation of the yellow; which must be melted, washed several times in water, divided into pieces, and layed upon linen cloths, which must be exposed for six weeks or two months to the sun, till it becomes white. Some make use of tartar, and chrys-tals of tartar, by which means they render it of a very fine white. When it is very white, clear, transparent, hard, brittle, tasteless, and will not stick to the teeth when chewed, it is best; for it is then emollient, and opening, as well as the yellow; but it is not so resolutive, because the greatest part of salts are washed away. Bees wax in substance, is seldom or never given inwardly; though it has been used to cure bloody fluxes; but it is prepared, by putting it into a hollow sweet apple, and which must be roasted under hot cinders, in such a manner, that the wax must melt, and enter into the substance of the apple. There must be about two drams of wax, and the whole must be given, thus roasted, in the aforesaid disorder; and the pain will vanish immediately. The butter of wax, gained by distillation, is good to resolve cold tumours, and for pains in the joints; as also for the palsey, as well as for parts that are frozen, and for chaps in the breast, when used as a liniment, and applied to the part affected. Four drops of the oil of wax, which is nothing but the butter rectified, given in a proper water, is very diuretic, and is good in the nephritic cholic. Some give ten drops for this purpose.

The propolis taken notice of above, is an attenuant and resolvent, and good to ripen boils, as well as for malignant ulcers. It is mixed in France, in plasters and in ointments, and if the vapour of it is received into the mouth, by means of a funnel, it is said to be very good to mitigate inveterate coughs. The method is, to throw bits into a chafing-dish that has fire in it.

There are several kinds of wax, and of different colours, which are occasioned by the ingredients that are added thereto. Thus green wax is composed of white wax, softened with a little turpentine, and colour-ed with verdigrease in fine powder. This is good for corns in the feet, being applied thereto in the form of a plaster. Red wax is made in the same manner, with the addition of vermillion; it is resolvent, when applied outwardly.

The *Bee Fly* is a sort of species by itself, it being of a nature between a Bee and a common Flie, and it feeds its brood with a sort of sweet paste. The trunk differs from that of the common Bee, for its greatest part is hid in a sort of shelly sheath; and when it is thrust out of it, it is accompanied with a sort of threads, four in number; but when it is not used, it lies under the teeth. Under these there is a sort of a fleshy

fleshy feet, which is the real tongue of this Fly, with which it licks the trunk. The body is longer than that of any other Bee, and the rings that compose the trunk nearest the breast-plate, are reddish on the upper part. They make their nests in the earth, nine or ten inches deep; and some of these Flies are armed with a sting, which are the females; but the males, which are larger, have none.

The *Tapestry Bees* are so called, from lining their nests with a sort of tapestry, which they get from the flowers of the wild poppy, newly blown, placing bits thereof at very small distances from each other. The places where they chuse to build their nests in the earth, are by the sides of highways, and the paths in corn fields. It is more hairy than the common Bee, but much of the same colour, only shorter in proportion; when their nest is finished, they fill it with paste like some of the former.

There are several sorts of foreign Bees, particularly those of *Gaudaloupe*, which are less by one half than the *European*, and they are more black and round. They have no sting, and they make their hives in hollow trees, where if the hole that they meet with, is too large, they make themselves a sort of a waxen house, in the shape of a pear, and in which they lodge, place their honey, and lay their eggs. Their wax is black, or at least of a deep violet-colour. They lay up their honey in waxen vessels, of the size of a pigeon's egg, and in the shape of the air bladders of carps; and they are so joined together, that there is no space left between them. The honey is always fluid, of the consistence of oil, olive, and of the colour of amber. The wax is always too soft for candles, and therefore they make use of it instead of corks, to stop up their bottles; and it is very good to soften corns on the feet, and warts on the hands, and when it has been applied for some time, the corns may be drawn out.

In *Ethiopia* there are little black Bees that make excellent honey, and they have no sting. In the *Canary Islands*, there are swarms of Bees on the mountains, which produce large quantities of honey, but they are of different kinds. The Bees of *Guiney* make excellent wax, and delicious honey. In *Congo* and *Angola* there are two sorts of Bees, one of which make their nest in the middle of woods, and the other on the roofs of houses. Authors and travellers take notice of several sorts of Bees, but as they are not particularly described, nothing more needs to be said about them.

C H A P. IX.

OF INSECTS OF THE ANT KIND.

THE *Ant* is an insect that keeps together in companies like the Bees, and maintain a sort of a republic, governed by laws. The nest is not exactly square, but longer one way than the other, and in it there are a sort of paths, which lead to different magazines. Some of the Ants are employed in making the ground firm, by mixing it with

a sort of glue, for fear it should crumble, and fall down upon their heads. They may be sometimes seen to gather several twigs, which serve them for rafters, which they place over the paths, to support the covering ; they lay others across them, and upon them rushes, weeds, and dried grass, which they heap up into a double declivity, which serves to turn off the water from their magazines. Some of these serve to lay up their provisions in, and in others they lay their eggs.

As for the provisions, they lay up every thing that is fit for them to eat ; and you may often see one loaded with pippin, or grain of fruit, another with a dead Flie, and several together with the carcase of a May-bug, or other insect. If they meet with any they cannot bring away, they eat it upon the spot, or at least so much of it, as may reduce it to a bulk small enough for them to carry. They do not run about where they please, at all adventures ; for some of them are sent abroad to make discoveries ; and if they bring back news they have met with a pear, or a sugar-loaf, or a pot of sweetmeats, they will run from the bottom of the garden, as high as the third story of a house, to come at it. They all follow each other in the same path, without wandering to the right or the left ; but in the fields they are more at their liberty, and are allowed to run about in search of game. There is a sort of green Flie, that does a great deal of mischief among the flowers, and which curl up the leaves of peach and pear-trees ; and these are surrounded with a sort of glue, or honey, which the Ants hunt after very greedily ; for they touch neither the plant nor the Flies themselves ; however this is sometimes thought to be done by the Ants, which raises them a great many enemies, who endeavour to destroy them, though they are really innocent of the fact.

Next to this, their greatest passion is to lay up hoards of wheat, and other corn, and for fear the corn should sprout by the moisture of the subterraneous cells, they gnaw off the end which would produce the blade. The Ants are often seen pushing grains of wheat, or barley, much larger than themselves.

The Ants after having spent the summer in labour, keep close in the winter, enjoying the provisions that they have laid up. However some think they sleep in the winter, like other insects, and they do not lay in the corn for winter provisions, but to provide a store that is necessary to feed their brood with. They feed them as soon as they proceed from the eggs, with incessant care, which employs the whole company. The young ones, when they proceed from the egg, are no larger than grains of sand. After they have been fed for some time, they weave themselves a covering of white or yellow stuff, and then they leave off eating, and become Chrysalides ; many people, while they are in this state, take them for Ant's eggs. But they are in reality the nymphs from whence the young Ants proceed.

In *Africa*, and particularly in *Guiney*, the Ants are exceeding troublesome, and do a great deal of mischief. They make their nests twice as high as a man, of earth in the fields ; besides which they build large nests in high trees, from which places they advance to the *European* settlements, in such prodigious swarms, that they frequently oblige the inhabitants to quit their beds in the night time. They will sometimes attack a living sheep, which in a night's time, they will reduce to a perfect skeleton, leaving not the least thing except the bones. It is

common for them to serve domestic fowls in the same manner, and even the rats themselves cannot escape them. If you place a Worm or a Beetle, only where one or two Ants are, they will immediately depart, and bring with them above an hundred; after which they seize their prey, and march off with it in good order. These Ants are of various sorts, some great, others small, some black, and others red; the sting of this last is very painful, and causes an inflammation; the white are as transparent as chrystral, and have such strong teeth, that in a night's time, they will eat their way through a thick wooden chest, and make it as full of holes, as if it had been penetrated by hail shot.

There are also several sorts of Ants in the *East-Indies*; whose numbers are prodigious; some of them are exceeding large, and of a ruddy colour, inclining to black, and some have wings, but others have none. They are very pernicious to the fruits of the earth, and do a great deal of mischief in houses, unless great care is taken to prevent them. It is remarkable, that if one Ant meets another that is loaden, it always gives way to let it pass freely.

1. The *Horse-ant* is the largest of this kind in *England*, being twice as big as the common sort; it has a black head, and has a breast of a dusky iron-grey colour, only it is black towards the hinder part, and white at the other extremity. The legs are iron-grey, and the scale which is placed between the body and the breast is of a roundish oval figure, pointed at the top, and undivided; the body is brown, and consists of five segments. It is usually met with in hollow trees.

2. The red *Ant* is smaller than the common sort, having a small head, and a large breast; and the scale which separates that from the body, is of a roundish shape, and slightly dentated. The legs are slender, and the wings are very thin, and of a brownish colour. It is met with in dry pastures, on the leaves and stalks of the smaller weeds.

3. The black *Ant* is neither so large as the common sort, nor so small as the red Ant, its head is large, in proportion to the body, and the breast is flattened, being at some distance from the hinder part. The scale that separates them, is of an oval shape, and undivided on the edges; the legs are longer and slenderer than in the other kinds. It is met with in heaths, and in dry pastures.

4. The common *Ant* is of a dark brown or reddish colour, with long legs, on the hindermost of which it will raise itself, as if it wanted to see at a distance. It has a large head, at the upper end of which there are two prominent eyes, like those of a Flie, but smaller. On the snout there are two horns or feelers, and beyond them two indented jaws, which open side ways, very wide, and at the ends of them there are teeth, which slide on the side of each other, when the mouth is shut. With these it is able to hold a body three times its own weight. It has six legs, shaped like those of a Flie, and the body consists of three joints or segments, and some of them have long wings, with which they are enabled to fly where they please. The whole body is cased with a sort of armour, and when viewed through a microscope, seem covered with multitudes of small white shining bristles, and the legs, feelers, head, and the middle part of the body, are furnished with hairs, that are smaller, and of a darker colour. Some have observed, that as in Bees, those that make up the great body of the Ants, are neither male nor female, these last only having wings, and the rest none. The



males
females

females are the largest, the males of a middle size, and the working Ants much less than either.

5. The *American Ant* is of a very large kind, and so voracious, that they will devour all the leaves of a tree in a night's time. They have two crooked teeth, which meet each other like nippers, with which they cut the leaves of trees, and other things that they feed upon. They sometimes cut them off, and when they are fallen to the ground, they carry them to their nests to feed their brood. These Ants, when they are arrived to their full growth, shed their coats in the same manner as Flies that proceed from Caterpillars, and then become winged insects, in which state they lay their eggs. They make their holes in the earth of a great depth, and build their nests very artificially. They are great enemies to all other insects, and when they rove abroad, which is always once a year, they will go into every room of a house, and kill all the Spiders, and other insects that are therein.

The *American Velvet Ant* is of the size of a Hornet, and the body is elegantly marked with black and crimson velvet: the breast is so strong and hard, that though they are trod upon by men or cattle, they receive no harm: they have a long sting in their tails, which occasions great pain and inflammation.

The *Ants of Brazil in South-America*, are very numerous, and devour every thing that comes in their way, whether fruit, flesh, fish, or insects. There is also a flying Ant, an inch in length, with a triangular head, and the body separated into two parts, being only joined together by a small string. On the head there are two slender and long horns, or feelers, and their eyes are very small. On the fore part or breast, there are six legs, consisting of three joints, and they have four thin transparent wings, the hindermost of which are round, and are of a bright brown colour. They dig into the ground like moles; but they are eaten by the negroes.

There is another large *Ant*, resembling a Flie, whose body is separated into three distinct parts, the hindermost of which for shape and size, resembles a barley-corn; the middlemost is of an oblong shape, with six legs, each of which is near half an inch long, and consist of four joints: the fore part, or head, is pretty thick, and in the shape of a heart, with two horns or feelers, and as many black crooked teeth: the eyes round the pupils, are inclining to black, and the fore and hind parts of the head are of a bright red colour.

There is also a bright black *Ant* with bright rough legs, near an inch in length with a large four-square head, and prominent black eyes and teeth, with two horns or feelers, near half an inch long: the body of this is also separated into three parts, the foremost of which is of an oblong shape, but not very thick, with six legs, each of which is near half an inch long: the middle part is small and square, not exceeding the bigness of a louse: that behind is the largest of the three, and is of an oval figure, only it is sharp at the end: the three parts are fastened together by a sort of string.

The chestnut brown *Ant* is also a native of *Brazil*, and has a head as large as that of other Ants, with two horns or feelers, and two tusks instead of teeth: the whole body is covered with hair, and is divided into two parts, the foremost of which has six legs, and is somewhat less than that behind. At certain seasons of the year it has four wings, the

the foremost of which are somewhat larger than the hindermost, but it loses them again after a certain time.

Linnaeus takes notice of four sorts of *Ants*, namely, the horse Ant, the red Ant, the black Ant, and the corn Ant.

C H A P. X.

OF THE ANT.

(FROM GOLDSMITH.)

THOUGH the number of two-winged flies be very great, and the naturalists have taken some pains to describe their characters and varieties; yet there is such a similitude in their forms and manners, that in a work like this, one description must serve for all. We now therefore, come to a species of four-winged insects, that are famous from all antiquity, for their social and industrious habits, that are marked for their spirit of subordination, that are offered as a patron of parsimony to the profuse, and of unremitting diligence to the flaggard.

In the experiments, however, which have been more recently made, and the observations which have been taken, much of their boasted frugality and precaution seem denied them; the treasures they lay up, are no longer supposed intended for future provision, and the choice they make in their stores, seems no way dictated by wisdom. It is, indeed, somewhat surprising, that almost every writer of antiquity should describe this insect, as labouring in the summer, and feasting upon the produce during the winter. Perhaps, in some of the warmer climates, where the winter is mild, and of short continuance, this may take place; but in France and England, these animals can have no manner of occasion for a supply of winter provisions, as they are actually in a state of torpidity during that season.

The common ants of Europe, are of two or three different kinds; some red, some black, some with stings, and others without. Such as have stings inflict their wounds in that manner; such as are unprovided with these weapons of defence, have a power of spurting, from their hinder parts, an acid pungent liquor, which, if it lights upon the skin, inflames and burns it like nettles.

The body of an ant is divided, into the head, breast, and belly. In the head the eyes are placed, which are entirely black, and under the eyes, there are two small horns or feelers, composed of twelve joints, all covered with a fine silky hair. The mouth is furnished with two crooked jaws, which project outwards, in each of which are seen incisures, that look like teeth. The breast is covered with a fine silky hair, from which project six legs, that are pretty strong and hairy, the extremities of each armed with two small claws, which the animal uses in climbing. The belly is more red than the rest of the body, which is of a brown chesnut colour, shining as glass, and covered with extremely fine hair.

From such a formation, this animal seems bolder, and more active, for its size, than any other of the insect tribe, and fears not to attack a creature, often above ten times its own magnitude.

As soon as the winter is past, in the first fine day in April, the ant-hill, that before seemed a desert, now swarms with new life, and myriads of these insects are seen just awaked from their annual lethargy, and preparing for the pleasures and fatigues of the season. For the first day they never offer to leave the hill, which may be considered as their citadel, but run over every part of it, as if to examine its present situation, to observe what injuries it has sustained during the rigours of winter*, while they slept, and to mediate and settle the labours of the day ensuing.

At the first display of their forces, none but the wingless tribe appears, while those furnished with wings remain at the bottom. These are the working ants, that first appear, and that are always destitute of wings; the males and females, that are furnished with four large wings each, are more slow in making their appearance.

Thus, like bees, they are divided into males, females, and the neutral or the working tribe. These are all easily distinguished from each other; the females are much larger than the males; the working ants are the smallest of all. The two former have wings; which, however, they sometimes are divested of; the latter never have any, and upon them are devolved all the labours that tend to the welfare of the community. The female, also may be distinguished, by the colour and structure of her breast, which is a little more brown than that of the common ant, and a little bigger than that of the male.

In eight or ten days after their first appearance, the labours of the hill are in some forwardness; the males and females are seen mixed with the working multitude, and pursued or pursuing each other. They seem no way to partake in the common drudgeries of the state; the males pursue the females with great assiduity and in a manner force them to compliance. They remain coupled for some time, while the males thus united, suffer themselves to be drawn along by the will of their partner.

In the mean time, the working body of the state takes no part in their pleasures, they are seen diligently going from the ant-hill, in pursuit of food for themselves and associates, and of proper materials for giving a comfortable retreat to their young, or safety to their habitation. In the fields of England, ant-hills are formed with but little apparent regularity. In the more southeren provinces of Europe, they are constructed with wonderful contrivance, and offer a sight highly worthy a naturalist's curiosity. These are generally formed in the neighbourhood of some large tree and a stream of water. The one is considered by the animals, as the proper place for getting food; the other for supplying them with moisture, which they cannot well dispense with. The shape of the ant-hill, is that of a sugar loaf, about three feet high, composed of various substances; leaves, bits of wood, sand, earth, bits of gum, and grains of corn. These are all united into a compact body, perforated with galleries down to the bottom, and winding ways within the body of the structure. From this retreat, to the water, as well as to the tree, in different directions, there are many paths worn by constant assiduity, and along these the busy insects are seen

seen passing and repassing continually; so that from May, or the beginning of June, according to the state of the season, they work continually, till the bad weather comes on.

The chief employment of the working ants, is in sustaining not only the idlers at home, but also finding a sufficiency of food for themselves. They live upon various provisions, as well of the vegetable as of the animal kind. Small insects they will kill and devour; sweets of all kinds they are particularly fond of. They seldom, however, think of their community, till they themselves are first satiated. Having found a juicy fruit, they swallow what they can, and then tearing it in pieces, carry home their load. If they meet with an insect above their match, several of them will fall upon it at once, and having mangled it, each will carry off a part of the spoil. If they meet, in their excursions, any thing that is too heavy for one to bear, and yet, which they are unable to divide, several of them will endeavour to force it along; some dragging and others pushing. If any one of them happens to make a lucky discovery, it will immediately give advice to others, and then at once, the whole republic will put themselves in motion. If in these struggles, one of them happens to be killed, some kind survivor will carry him off to a great distance, to prevent the obstructions his body might give to the general spirit of industry.

But while they are thus employed in supporting the state, in feeding abroad, and carrying in provisions to those that continue at home, they are not unmindful of posterity. After a few days of fine weather, the female ants begin to lay their eggs, and those are as assiduously watched and protected by the working ants, who take upon themselves to supply whatever is wanting to the nascent animal's convenience or necessity. They are carried as soon as laid, to the safest situation, at the bottom of their hill, where they are carefully defended from cold and moisture. We are not to suppose, that those white substances which we so plentifully find in every ant-hill, are the eggs as newly laid. On the contrary, the ant's egg is so very small, that, though laid upon a black ground, it can scarcely be discerned. The little white bodies we see, are the young animals in their maggot state, endued with life long since freed from the egg, and often involved in a cone, which it has spun round itself, like the silk worm. The real egg when laid, if viewed through a microscope, appears smooth, polished, and shining, while the maggot is seen composed of twelve rings, and is often larger than the ant itself.

It is impossible to express the fond attachment which the working ants shew to their rising progeny. In cold weather they take them in their mouths, but without offering them the smallest injury, to the very depths of their habitation, where they are less subject to the severity of the season. In a fine day they remove them, with the same care, nearer the surface, where their maturity may be assisted by the warm beams of the sun. If a formidable enemy should come to batter down their whole habitation, and crush them by thousands in the ruin, yet these wonderful insects, still mindful of their parental duties, make it their first care to save their offspring. They are seen running wildly about, and different ways, each loaded with a young one, often bigger than the insect that supports it. I have kept, says Swammerdam, several of the working ants in my closet, with their young, in a glass filled with earth,

earth. I took pleasure in observing, that in proportion as the earth dried on the surface, they dug deeper and deeper to deposit their eggs; and when I poured water thereon, it was surprising to see with what care, affection, and diligence they laboured, to put their brood in safety, in the driest place. I have seen also, that when water has been wanting for several days, and when the earth was moistened after it a little, they immediately carried their young ones to have a share, who seemed to enjoy and suck the moisture.

When the young maggot is come to its full growth, the breast swells insensibly, it casts its skin, and loses all motion. All the members which were hidden before, then begin to appear, an aurelia is formed, which represents very distinctly, all the parts of the animal, though they are yet without motion, and as it were, wrapped up in swaddling-clothes. When at length, the little insect has passed through all its changes, and acquired its proper maturity, it bursts this last skin, to assume the form it is to retain ever after. Yet this is not done by the efforts of the little animal alone, for the old ones very assiduously break open, with their teeth, the covering in which it is inclosed. Without this assistance the aurelia would never be able to get free, as Mr. De Geer often found, who tried the experiment, by leaving the aurelia to themselves. The old ones not only assist them, but know the very precise time for lending their assistance, for if produced too soon the young one dies of cold, if retarded too long it is suffocated in its prison.

When the female has done laying, and the whole brood is thus produced, her labours, as well as that of the male, become unnecessary, and her wings, which she had but a short time before so actively employed, drop off. What becomes of her when thus divested of her ornaments is not well known, for she is seen in the cells for some weeks after. The males, on the other hand, having no longer, any occupation at home, make use of those wings with which they have been furnished by nature, and fly away, never to return, or to be heard of more. It is probable they perish with the cold, or are devoured by the birds, which are particularly fond of this petty prey.

In the mean time, the working ants having probably depos'd their queens, and being deserted by the males, that served but to clog the community, prepare for the severity of the winter, and bury their retreats as deep in the earth as they conveniently can. It is now found that the grains of corn, and other substances with which they furnish their hill, are only meant as fences to keep off the rigour of the weather, not as provisions to support them during its continuance. It is found generally to obtain, that every insect that lives a year after it is come to its full growth, is obliged to pass four or five months without taking any nourishment, and will seem to be dead all that time. It would be to no purpose therefore for ants to lay up corn for the winter, since they lie that time without motion, heaped upon each other, and are so far from eating, that they are utterly unable to stir. Thus what authors have dignified by the name of a magazine, appears to be no more than a cavity, which serves for a common retreat when the weather forces them to return to their lethargic state.

What has been said with exaggeration of the European ant, is however true, if asserted of those of the tropical climates. They build an ant-hill with great contrivance and regularity, they lay up provisions, and

and, as they probably live the whole year, they submit themselves to regulations entirely unknown among the ants of Europe.

Those of Africa are of three kinds, the red, the green and the black; the latter are above an inch long, and in every respect a most formidable insect. Their sting produces extreme pain, and their depredations are sometimes extremely destructive. They build an ant-hill of a very great size, from six to twelve feet high; it is made of viscous clay, and tapers into a pyramidal form. This habitation is constructed with great artifice, and the cells are so numerous and even, that a honey-comb scarce exceeds them in number and regularity.

The inhabitants of an edifice seem to be under a very strict regulation. At the slightest warning they will sally out upon whatever disturbs them, and if they have time to arrest their enemy, he is sure to find no mercy. Sheep, hens, and even rats are often destroyed by these merciless insects, and their flesh devoured to the bone. No anatomist in the world can strip a skeleton so cleanly as they, and no animal, how strong soever, when they have once seized upon it, has power to resist them.

It often happens that these insects quit their retreat in a body, and go in quest of adventures. "During my stay," says Smith, "at Cape Corse Castle, a body of these ants came to pay us a visit in our fortification. It was about day-break when the advanced guard of this famished crew entered the chapel, where some negroe servants were asleep upon the floor. The men were quickly alarmed at the invasion of this unexpected army, and prepared, as well as they could, for a defence. While the foremost battalion of insects had already taken possession of the place, the rear guard was more than a quarter of a mile distant. The whole ground seemed alive, and crawling with unceasing destruction. After deliberating a few moments upon what was to be done, it was resolved to lay a large train of gun powder along the path they had taken, by this means millions were blown to pieces, and the rear-guard perceiving the destruction of their leaders, thought proper instantly to return, and make back to their original habitation."

The order which these ants observe, seems very extraordinary; whenever they sally forth, fifty or sixty larger than the rest are seen to head the band, and conduct them to their destined prey. If they have a fixed spot where their prey continues to resort, they form a vaulted gallery, which is sometimes a quarter of a mile in length, and yet, they hollow it out in the space of ten or twelve hours.

C H A P. XI.

OF FLYING INSECTS WITH TWO WINGS.

THESE are commonly known by the name of Flies, and have transparent wings like gauze, and on which is no dust, as upon those of Butterflies; neither have they any cases to their wings, which distinguishes them from those of the Beetle kind. All Flies have a distinct head,

head, a corslet and a body ; the corslet is that part on which the wings are placed, and the body contains the guts, the stomach, and the parts of generation, with the greatest number of tracheæ, that is the organs that serve for respiration : the head is connected to the corslet by a very short neck, on which it will commonly turn round, as on a pivot. *Reaumur* observes, that some Flies have two corslets, distinct from each other, of which the first is smallest, and the other is that to which the wings are connected. The corslet is the roundest part, and is generally strongest and thickest, though sometimes it is not so broad as the body. The *Formica Leo* and some water Moths, are metamorphosed into Flies, that have a double corslet. Many naturalists have confounded Flies with four wings, with those that have but two ; besides which, they have often neglected to mention the number of wings ; but *Reaumur* divides them into two general classes, that is Flies that have two wings, and Flies that have four wings ; and under these he comprehends four subordinate classes. The first class comprehends Flies that have a trunk, and have neither teeth nor nippers. The second is composed of Flies that have a mouth without teeth. The third consists of Flies that have a mouth furnished with teeth ; and the fourth those that have both a trunk and teeth. Among those Flies that have a mouth and teeth, there are some that have not only teeth on the outside of the mouth, but within ; and these might have been placed in a fifth class.

All sorts of Flies that have two wings, belong to the first and second classes, for there are none of these that have the characteristics of the two other classes. The great blue flesh flies, and all those that are so troublesome in houses, as well as Gnats, are of the first class ; there are also Flies that resemble Gnats, which have a mouth without teeth, and these belong to the second class of two winged Flies. The Flies with four wings belonging to the third and fourth, are very numerous ; such as Bees which have a trunk, and two teeth above it, as well as all sorts of Wasps, which have a mouth and two teeth on the outside. Many sorts of Flies with four wings, belong to the second class, such as papillionaceous Flies, which proceed from different sorts of water Moths. Many sorts of Flies with four wings, belong to the first class, as the pucerons, called by some Vine-fretters, and others a-kin to them, as well as the Graftshoppers.

Reaumur has another sort, which constitutes a fifth class, and he calls them Heads in a trunk, because they have extremely long heads, from whence proceeds a very long snout, which is only open at the end. However he means that the place where the heads of other insects terminate, in these are prolonged, so as to form the shape of a trunk, which is stiff, and never changes its form or position, without changing the head itself. It is at the end of this lengthened part, that the teeth are placed, or at least the instruments by means of which these insects take their nourishments. One of this sort is the Scorpion Fly, so called, because the male generally keeps the back part turned up towards the back, like that of a Scorpion when it is about to sting. There is another beautiful Fly, which flutters about flowers, that is another instance of this kind.

Besides these classes *Reaumur* establishes a second rank, subordinate to the first, and whose characteristics are taken from what appears at first

first sight. These classes which are under the former, are characterized from the trunk, or from the mouth void of, or furnished with teeth; and having the head made in the form of a trunk. These are three in number, the first of which are Flies; with a short body, and more broad than thick; the second is those that have a long body, and the third is the Flies, whether long or short, that have the bodies joined to the corset by a single thread.

In order to characterize the kind of Flies which ought to be placed under these classes, *Reaumur* particularly attends to the constant varieties which may be taken from the carriage of their wings, the shape of the feelers, the carriage of their trunks, of the other external parts of the body, and more especially from the hinder parts. Flies of different kinds, may be considered while they are at rest, or while they are creeping, as well as in the different carriage of their wings, which is very evident in Butterflies. But there are more Flies that carry their wings parallel to the plane of position, than there are that keep them in inclined directions.

Among those that carry their wings parallel to this plane, some hold them like oars. Their direction is perpendicular to the length of the body, which is not covered by them at all. Of this kind are many of the long water Flies, and of those that have two wings, besides some kinds of Tipux. Other Flies carry their wings in such a manner, that they cover one part of the body, and not the other; whether the Flie has two wings or four, unless one of the upper wings sensibly intrenches upon the other upper wing. Among the Flies with two wings, the blue flesh Flies, and the common house Flies, are instances of this kind.

The wings of several sorts of Flies, cross each other over the body, and when this is done more or less, there arises differences easy to be observed. The wings of several Flies that cross the body, are roundish, and are not exactly parallel to the plane of position. The wing that is the uppermost, is more elevated over the line on the middle of the body, than on the sides. Thus the wings of those are disposed which proceed from the bastard Caterpillars. Some Flies have wings placed on the back, oneagainst another, and they are in a plane perpendicular to that of the position. Several sorts of small long water-flies, and several sorts of Pucerons, carry their wings in this manner. This is also observable in the Flie called the Ephemera.

The wings of several other Flies, are applied obliquely against the sides, and they meet over the body, at the inner edge, forming a sort of a root. Such is the manner of the small Lion Puceron. Other Flies have their wings likewise applied to the sides, but then they bend down over the back, making almost a flat roof; as, many of the Flies, which in their first state, were water Moths. Lastly, other Flies keep their wings obliquely to the plane of position, and in such a manner, that they meet under their bellies.

Other varieties in Flies, proceed from the texture of their wings. They are generally like a sort of fine gauze, for they have every where a nearly equal tincture and transparéncy; however the wings of several sorts of Flies are not very transparent, and others are quite opaque; insomuch, that at a distance, they might be taken for the wings of Butterflies. These are also called by *Reaumur* Papillionaceous Flies, that have their wings half transparent. Among the Flies with four

wings, there are the Papillionaceous, whose lower wings are very transparent, while the upper are a little opaque, which is observable in the Flies of several water Moths. Other Flies have opaque spots on their fore wings, on a very transparent ground, these may be seen in Scorpion Flies. There are also Flies with two wings, with dark spots thereon, separated by transparent spaces.

The feelers likewise serve to distinguish the several kinds of Flies from each other. For there is as much difference among the feelers of Flies, as those of Butterflies. In some sort of Flies the feelers are jointed, and as it were composed of several grains, placed upon each other like beads. These are generally thicker at the roots than at the extremities. Other Flies have their feelers composed of joints like the former, but then they grow thicker towards the extremities, and these are called clavated feelers, that is, they are like clubs. The Flie of the Formico-Leo has this sort of feelers. Several small sorts of Flies, as Gnats, and some of the Tipulæ, have feelers like feathers, and others again in the shape of prisms; but these are jointed, and more slender at their ends than at the middle. Some Flies have branched or forked feelers, being composed of two articulated parts, and so each of them seem to be double; but these are only found in some sort of Butterflies. Others have their feelers very short, but extremely thick, and consist of only two or three joints, and these are met with in many sorts of Flies with four wings. Likewise the carriage of the feelers may serve for another distinction; as for instance, the Ichneumon Flie keep the feelers in continual agitation.

Flies may also be distinguished by their trunks, for some have them simple, and others armed with teeth or nippers. Some again have a sheath composed of a single piece, while others consist of several pieces joined together, and some have scaly sheaths, and some have fleshy; some are terminated with a sort of large lips, and others have none at all; but in many kinds, these varieties cannot be distinguished without a microscope. However the carriage of the trunk may be plainly seen by the naked eye; for some fold them up when they are not used, and others, while they are in action, keep them turned downwards; as for instance, Bees and Drones; in short others always keep them at full length, only they can turn them to different sides, as may be seen in Gnats, Grasshoppers, and the like. The shape of the head of all sorts of flies are not alike, for some have them almost round, others broader than long, and of a less diameter before than behind. The Formica-Leones differ from the Pucerons, not only in their feelers, but in their double corset. The corset of some Flies is much higher than in others, insomuch that it obliges them to turn the head downwards, and makes them appear hunch-backed. All Flies have but six legs, but they differ in the size in proportion to the body; for some have them very long, and others very short; as for instance, the Gnats and the Tipulæ seem to be mounted upon stilts. The legs of most Flies are joined to the corset, but in some, one of the pairs is attached to one of the rings of the body.

Besides, the latter part of the body serves for another distinction of Flies, for some are armed with stings, and others have a sort of piercer, lodged in a case. Others are provided with a kind of saw, which does not appear till the body is pressed. Likewise some have strings at their tails, as the Ephemera.

Most Flies are oviparous, that is, they lay eggs; but there are some that bring forth their young alive. Some herd together in companies, as Bees and wasps, and others are solitary, being generally found single. As for the species of every kind, they have only slight differences, which are not so essential as betwixt the kinds themselves.

The *Breeze*, or *Gad-Flie*, is of the size of a common blue flesh Fly, and has black large eyes, with feelers that consist of a long thread like a bristle, and the body is yellow, only it is surrounded with a black belt or stripe; the belly is of a tawny colour, except the last joint, which is black. The tail is long, bending under the belly, and the wings are whitish, and have a black line, with three black spots upon each. The female is said to lay her eggs in the backs of cattle, under the skin, where it lives in the state of a Maggot all the winter.

The grey *Fly*, or *Trumpet-Fly*, is considerably bigger than the common blue Fly, and the body is of a dusky-grey colour, approaching to black; it is smooth, except about the breast, which is beset with a great number of yellow long hairs; the wings are large and transparent, the body oblong, and the eyes large and black. The female lays her eggs in the nostrils of Sheep, Deer, and some other animals. It is called the Trumpet-Fly, from the noise it makes in the hot days of summer.

Linneus has four sorts of these Flies, to which he gives the general name of *Oestrus*; namely, the *Ox-Oestrus*, or *Gad-Flie*, the *Oestrus* that attacks the Rein-deer, the *Nostril Oestrus*, and the *Hæmorrhoidal Oestrus*. Others take notice of the larger Bee-like *Oestrus*, the smaller round-bodied *Oestrus*, the large black and yellow-bodied *Oestrus*, the black and yellow *Oestrus*, with black legs and transparent wings, the long bodied *Oestrus* with long wings, which is said to proceed from a worm that is bred in the guts of horses. The large roundish-bodied *Oestrus* with plain wings, that is said to proceed from a worm bred under water, and is called by some the *Tabanus Aquaticus*. The smaller oblong *Oestrus* with a pointed body, the *Oestrus* with spotted wings, a variegated body, and short legs; the black and tawny *Oestrus*. These sort have a style with a head under each wing, and they are noted for making cattle run about the fields as if they were mad.

The *Hornet-Fly* is as big as a common Hornet, and is so like it, that the one may be easily taken for the other: the head is large, the snout long and black, with a sharp point, and the eyes are prominent, the breast is large and bunched, and of a dusky colour, but the wings, legs, and belly, are of an iron-grey; the body on its upper part, is black and yellow, and consists of seven joints, the three uppermost of which are black, and the rest yellow.

The *Wasp Fly* is of the size of a common Wasp, and very much resembles it in shape and colour. The head is smooth and yellowish, the body blunt, and all its joints, at the edges, are of a pale yellow, and the snout is long, and pointed at the end.

The Virginian *Hornet Fly* is of the size of our largest Flies, and has a black head, with a silver line that runs from the shoulders to the mouth; it has likewise large black eyes. It has a long and strong weapon on its mouth, and the shoulders are of a blackish-brown, with two silver wings. At the back part there are seven or eight joints, of

a whitish colour, but the other parts are blackish, except the belly, which is of a yellowish ash-colour, with a greenish cast.

The Muscovite *Hornet-Flie* has a very long body, with oblong large eyes, that take up the greatest part of the head. The snout is black, hardish, and divided into three parts, with which it can penetrate through cloth, and hurt the skin of the person that wears it.

Linnæus calls these sort of Flies *Asilus*, of which he has four sorts, namely, the rapacious Fly, the hairy *Asilus*, the *Asilus* with round wings, and the *Asilus* that pricks the legs through the stockings.

Other authors have the long slender bodied great *Wolf-fie*, the great smooth black and red *East-Indian Asilus*. The black legged smooth yellow *Asilus* with blue wings. The *Asilus* with a blue body, variegated with black streaks. The black hairy *Asilus*, with brown legs and white wings. The *Asilus* with the body variegated with a black and reddish colour. The smooth *Asilus* with black wings, and a black body. The black *Asilus* with roundish iron-grey wings. The black *Asilus* with white streaks and spots. The willow *Asilus* with white wings, marked with two transverse black streaks. The smooth *Asilus* with a black body and grey wings. The smooth oval-grey *Asilus*.

The common *Horse Fly* is pretty large, and has a body of an oblong shape, and rounded at the end; it is of a grey colour, and has a smooth skin, with large eyes, and large transparent wings. Each of its legs are terminated by four short and sharp claws, and it has a clavated snout, in the shape of a cylinder, being blunt at the end, and the tongue is like a bristle.

The swallow's-nest *Flie* is but small, and has a small head. The breast is somewhat in the shape of a cone, and the body is broadest at the extremity. The wings are long, but remarkably narrow, and the legs are all terminated with six short claws. The former of these is exceedingly troublesome to horses and cattle, and sticks on firmly wherever they lay hold; sometimes they will make horses almost mad, and the last is frequently seen on the necks of horses.

Linnæus calls these sort of Flies *Hippobosca*, and has only two sorts, namely, the common *Horse Fly*, and the *Sheep Fly*, or rather the *Hippobosca* without wings. Other authors have the long-bodied dusky-brown *Hippobosca*. The black *Hippobosca* with an oval body, the *Hippobosca* with a round body and short wings. The snouts of these are all alike.

The great *Horse Fly* has a greyish head, and large black eyes, with large broad transparent wings, but of a dusky colour, and marked with iron-grey lines. The breast and body are grey, only the back part under the wings, are a little yellowish, and in the center of each of the rings, all the way down the back, there is a triangular white spot. The thighs are black, and the legs yellow.

The *East-Indian Horse-Flie* is a most pernicious insect, and it stings or bites most terribly. They are about two inches broad, and as much long, and of a brown colour, with a yellow streak along the body. They build their nests very curiously on the rafters of barns or out-houses, as the *East-Indian Wasps* do on the twigs of trees; in these they lay their eggs, and hatch their young ones, and they feed upon fruits. After they are killed, they have a most disagreeable smell.

The green *Horse-Flie* was brought from *China*, and has the body and under wings of a fine shining green, which have the lustre of polished metal; the tips of their wings, and their under sides, are dusky or black, but the upper wings are of a light brown colour, being very thin and transparent.

The purple and brown *Horse-Flie* is a native of the *West-Indies*, and the wings are of a dirty purplish brown, with some transparent spots thereon.

The *Burrel Flie* has an oblong body, which is divided into three principal parts, namely, the head, the shoulders, and the belly, which last is divided into five or six joints or rings. It is all over of a whitish colour, inclining to black, or rather grey, and it has a strong, brawny, long snout. In *July* and *August* it is very troublesome to horses and cattle. *Mouset* gives us an instance of a horse that was tied with a halter to a tree in a wood, where he was killed in six hours time by these Flies, which he supposed was owing to the great loss of blood, of which they are very fond.

Linnaeus calls these sort of Flies *Tabanus*, of which he has only two sorts, the common *Tabanus* and the *Tabanus* that can see but very little; but *Ray* has one which he calls the beautiful two winged Flie, with large white spots on the wings. It is of the size of the common House-fly, and has a brown head, breast, and body, only there is a yellowish tincture under the roots of the wings: the eyes are large, of a bright shining green, with a few black specks.

Other authors have the black *Tabanus*, variegated with yellow, and with brown legs: the brown *Tabanus* with iron-grey sides, and three brown streaks over the eyes: the grey *Tabanus* with a transverse line over the eyes: the brown *Tabanus* with grey wings, variegated with small white spots, with green eyes, and four brown lines running over them: the long-bodied *Tabanus*: the *Tabanus* with a short body, and transparent wings: the black *Tabanus* with transparent wings.

The *Flie* with white wings, and a black spot on each, has a red large head, and a short blunt black body, and black legs; the eyes are large, and while sitting, it is constantly shaking its wings; they are common in orchards upon apple-trees.

The *Hairy-Flie* is of a large kind, and has a body of a black oval shape, and its extremities are covered with a great number of yellowish hairs, as well as the breast: the head and legs are black, and the wings transparent, only they are whitest towards the base, and have each a large iron-grey spot towards the outer edge: this is not a very common Flie.

The black *Flie* is pretty large, and has a body of an oval blunt shape, the breast is oblong, the head and eyes large, and the legs are black: the sides are marked each with a very large pale-coloured spot, and the tail is beset with black hairs; moreover the sides of the belly are covered with somewhat of a shelly substance.

The green *Flie* is as big as the blue flesh *Flie*, and has a black head, with large eyes; the breast and body are of a beautiful green, with somewhat of a brassy yellow cast, which in some lights appear bright and shining: the legs are black, the eyes brown, and there is a double transverse line on the belly; the body is of an oval shape, and has four joints.

The grey *Flie* is not unlike the common House-*Flie*, but not half so large: the eyes are reddish, the breast grey, but marked with two smaller, and two larger black spots: the body is greyish, and consists of four joints; the first of which is without spots, but the second has a three-toothed mark at its base, and the third and fourth has spots nearly of the same kind: this is a very common *Flie*.

There are several sorts of these insects, that are properly called *Flies*, which we shall range under several classes. Of those that resemble the common House-*Flie*, are,

1. The common house *Fleſh-Flie* with a black chequered body, and with oblong black streaks on the breast.
2. The black *Flie* with a white forehead.
3. The black *Flie* with a smooth glossy body.
4. The smooth black *Flie* with iron-grey eyes, and the base of the thighs whitish: this *Flie* proceeds from maggots in cheese.
5. The smooth black *Flie* with the edges of the wings black, and thicker than the other part.
6. The somewhat hairy black *Flie* with nervous wings.
7. The grey *Flie* with fine black marks on the breast, and three toothed spots on the belly.
8. The yellow *Flie* with the belly brown on the upper part, and three black streaks on the breast.
9. The yellow *Flie* with black eyes.

Of the shining or gilded *Flies* there are,

1. The *Flie* with a shining blue breast, and a shining green body.
2. The *Flie* with a shining green breast, and a shining blue body.
3. The *Flie* with a black breast and green body.
4. The *Flie* with a black breast and blue body.
5. The *Flie* with an oblong body, of a copper-colour, and a green head, a yellow breast, and the wings marked with a brown spot.
6. The oblong *Flie* with a brassy breast, and the body yellow on the fore part, and black behind.

It will not be improper to mention here the *North American Fly*, there called the *Fire-Flie*, because it appears like a spark of fire in the dark: they are as long as the Bees called *Drones*, but much thicker, and are of a brownish colour: the light proceeds from under the wings, and they are a strange sight to new comers at first. When their wings are broken, and they are placed on a book in a dark room, they shine so much, that the letters near it may easily be distinguished: they appear in *May*, and are visible the greatest part of the summer; there are sometimes such a multitude of them in the woods, that they yield a very wonderful, and yet pleasing sight: they continue flying every hour in the night, but are never seen by day.

The *Fire-Flies* of the *East-Indies*, are about an inch broad, and as much in length, or longer; the head which is brown, has two small horns or feelers, and the neck is red: they have four wings, and so do not properly belong to this class, the uppermost of which are hard and brown, and those underneath soft: the shining substance is contained in a black bag on their backs, which they hide with their wings when they sit. In the rainy season there are prodigious swarms of them among the trees, and they feed chiefly upon their blossoms: there are several sorts of these *Flies* in the *East-Indies*.

The West-Indian *Fire-Flie*, *Pere de Tertre* affirms, is like a living star, of which there are great numbers, that in dark nights make the air seem full of curious lights, which shine and sparkle more than the stars in the sky: they do not shine at all in the day, and therefore are never taken notice of by any that are unacquainted with them: they have somewhat of the appearance of dirty Beetles, and they delight to be among rotten wood till the sun is set, and then they fly here and there, seeming to be so many lighted candles carried in the woods and houses, by invisible hands: they will pursue the light of a candle, and other things that sparkle or shine, with so much ardour, that they often kill themselves, like our Moths, especially if a burning coal is laid in their way. He tells us very gravely, and no doubt with some truth, that the poorer popish clergy, when they want candles or oil, catch one of these Flies, by whose light they will be able to read their matins as easily as if they had a lamp. While they are alive and in full health, a flame seems to proceed from all parts of the body; but when they are sick, it grows weak, and when they die, it is quite extinguished. When they are caught, they live but fifteen days, or three weeks at most.

The *Fire-Flie* of *Martinico* mentioned by *Pere du Tertre*, is not so large as a common Flie: they yield a sort of sparkling golden light, which is extremely agreeable; but they will often hide it for a little while, and then they begin to shine again, and thus they continue all the night: this shining resides in a sort of white substance, of which they are full, and they can make it appear through the chinks of their skin, when they please.

Of *Flies* which in a worm state feed upon trees and plants, and the insects thereon, are,

1. The *Flie* with a black oval body, with two marks in the shape of half-moons, and three yellow belts.

2. The *Flie* with an oval body, and three pair of whitish half moons, called by authors, the Elephant's trunk. It feeds in its worm-state, on the pear tree.

3. The oblong yellow-bodied *Flie* with black transverse lines.

4. The oblong yellow-bodied *Flie* with three pair of yellow spots.

5. The long-bodied *Flie* with six three-cornered yellow spots.

6. The *Flie* with the body in the shape of a cylinder, with six spots in the shape of half-moons, on the back.

7. The grey *Flie* with four black spots on the back.

8. The oblong-bodied *Flie* whose hinder legs are largest.

9. The *Flie* whose body is marked with three yellow circular lines.

Of *Flies* that have variegated bodies, there are,

1. The black *Flie* with the bases of the wings of an iron-grey.

2. The *Flie* with a grey breast, and the base of the belly marked with a yellow spot, and having the edges of the segments whitish.

3. The black *Flie* with all the segments of the body, except the first, yellow, and a black mark in the middle.

4. The *Flie* with a yellow breast, with four yellow transverse lines, on the belly part, the first being larger than the rest, and interrupted.

5. The *Flie* with four yellow streaks on the breast, and three of the segments of the belly part yellow.

6. The black *Flie* with a white body, and two black streaks thereon.

7. The brown and somewhat hairy *Flie*, with the edge of the belly sharp, and having three yellow lines, with a triangular spot.
8. The *Bee-Flie*, produced from the long-tailed maggot of necessary houses: the black *Flie* with a velvet body, marked with three transverse lines.
9. The black *Flie* with two yellow belts on the back.
10. The black *Flie* with iron-grey wings, and three white interrupted belts on the back.
11. The brown *Flie* with iron-grey wings, and the edges of the segments of the body grey.

Of the hairy *Flies* there are,

1. The black *Flie* with the edges of the wings thin, scalloped, and whitish.
2. The common hairy dung *Flie* with a spot on each of the wings.
3. The black *Flie* with the base of the belly-part white, and its extremity brown.
4. The *Flie* with a grey breast, and the point of the belly-part white, and the wings marked with an iron-grey spot.
5. The *Flie* with a grey breast, and a black body, having a dusky iron-grey spot, on each of the wings.
6. The *Flie* with a white body, except behind, where it is black, and having white wings, marked with a black spot.
7. The *Flie* with a yellow breast, and a brown spot on the wings.
8. The grey *Flie* with iron-grey wings, and a brown spot on each.

Of *Flies* that have variegated wings, there are,

1. The *Flie* with black wings tipped with white.
2. The *Flie* with two black spots on each wing.
3. The *Flie* with white wings and a single black speck on the extremity of each.
4. The unguiculated winged *Flie*, with white wings, and a black spot in the middle.
5. The black *Flie* with the wings variegated on the fore part, with black and white.
6. The *Flie* with grey wings, spotted with black.
7. The grey *Flie* with unguiculated wings, spotted with brown.
8. The *Flie* with white wings, whose edges are black, and marked with black spots.
9. The *Flie* with white wings, and three brown specks, and a brown spot at the end.
10. The *Flie* with white wings, marked with four grey streaks, and as many smaller, running alternately between them.
11. The *Flie* with white wings, marked with four streaks, and having five pair of spots on the back.
12. The green-eyed *Flie* with white wings, and marked with the letter S, in a double line, of a brown colour.
13. The *Flie* with white unguiculated wings, marked with four brown streaks, and having the extremity of the breast yellow.
14. The *Flie* with pale wings, marked with black veins, and two transverse undulated brown lines, and brown tips.
15. The *Flie* with membranaceous wings, spotted with black, and three rows of black specks on the body.

Linnaeus has only eleven sorts of these Flies, namely, the water Flie, the Summer Flie, and the Cherry tree Flie; these have variegated wings: the dung hairy Flie, the wonderful Flie, the putrid Flie; and the Flie of the necessary house: these three have variegated bodies: the Elephants trunk Flie: the flesh Flie, the house Flie, and the Flie that is bred in cheese.

C H A P. XII.

OF THE GNAT AND TIPULA.

(FROM GOLDSMITH.)

THESE are two insects which entirely resemble each other in their form, and yet widely differ in their habits, manners, and propagation. Those who have seen the tipula, or long-legs, and the larger kind of gnat, have most probably mistaken the one for the other, they have often accused the tipula, a harmless insect, of depredations made by the gnat, and the innocent have suffered for the guilty; indeed the differences in their form are so very minute, that it often requires the assistance of a microscope to distinguish the one from the other: they are both mounted on long-legs, both furnished with two wings and a slender body; their heads are large, and they seem to be hump-backed; the chief and only difference, therefore, is, that the tipula wants a trunk, while the gnat has a large one, which it often exerts to very mischievous purposes. The tipula is a harmless peaceful insect, that offers injury to nothing; the gnat is sanguinary and predaceous, ever seeking out for a place in which to bury its trunk, and pumping up the blood from the animal in large quantities.

The gnat proceeds from a little worm, which is usually seen at the bottom of standing waters. The manner in which the insect lays its eggs is particularly curious; after having laid the proper number on the surface of the water, it surrounds them with a kind of unctuous matter, which prevents them from sinking; but at the same time fastens them with a thread to the bottom, to prevent their floating away, at the mercy of every breeze, from a place the warmth of which is proper for their production, to any other, where the water may be too cold, or the animals its enemies too numerous. Thus the insects, in their egg state, resemble a buoy, which is fixed by an anchor. As they come to maturity they sink deeper, and at last, when they leave the egg as worms they creep at the bottom. They now make themselves lodgments of cement, which they fasten to some solid body at the very bottom of the water, unless, by accident, they meet with a piece of chalk, which being of a soft and pliant nature, gives them an opportunity of finding a retreat for themselves, where nothing but the claws of a cray-fish can possibly molest them. The worm afterwards changes its form. It appears with a large head, and a tail invested with hair, and moistened with an oleaginous liquor, which she makes use of as a cork, to

sustain her head in the air, and her tail in the water, and to transport her from one place to another. When the oil with which her tail is moistened begins to grow dry, she discharges out of her mouth an unctuous humour, which she sheds all over her tail, by virtue whereof, she is enabled to transport herself where she pleases, without being either wet or any ways incommoded by the water. The gnat, in her second state, is properly speaking, in her form of a nymph, which is an introduction, or entrance into a new life. In the first place, she divests herself of her second skin; in the next she resigns her eyes, her antennæ, and her tail; in short, she actually seems to expire. However, from the spoils of the amphibious animal, a little winged insect cuts the air, whose every part is active to the last degree, and whose whole structure is the just object of our admiration. Its little head is adorned with a plume of feathers, and its whole body invested with scales and hair, to secure it from any wet or dust. She makes trial of the activity of her wings, by rubbing them either against her body, or her broad side bags, which keep her in an equilibrium. The furbelow, or little border of fine feathers, which graces her wings is very curious, and strikes the eye in the most agreeable manner. There is nothing, however, of greater importance to the gnat, than her trunk, and that weak implement may justly be deemed one of Nature's master pieces. It is so very small, that the extremity of it can scarcely be discerned through the best microscope that can be procured. That part which is at first obvious to the eye, is nothing but a long scaly sheath under the throat. At near the distance of two-thirds of it, there is an aperture, through which the insect darts out four stings, and afterwards retracts them. One of which, however sharp and active it may be, is no more than the case in which the other three lie concealed, and run in a long groove. The sides of these stings are sharpened like two edged swords; they are likewise barbed, and have a vast number of cutting teeth towards the point, which turns up like a hook, and is fine beyond expression. When all these darts are stuck into the flesh of animals, sometimes one after another, and sometimes all at once, the blood and humours of the adjacent parts must unavoidably be extravasated; upon which a tumour must consequently ensue, the little orifice whereof is closed up by the compression of the external air. When the gnat, by the point of her case, which she makes use of as a tongue, has tasted any fruit, flesh, or juice, that she has found ~~at~~; if it be a fluid, she sucks it up, without playing her darts into it; but in case she finds the least obstruction by any flesh whatever, she exerts her strength, and pierces through it, if possibly she can. After this she draws back her stings into their sheath, which she applies to the wound in order to extract, as through a reed, the juices which she finds inclosed. This is the implement with which the gnat performs her work in the summer, for during the winter she has no manner of occasion for it. Then she ceases to eat, and spends all that tedious season either in quarries or in caverns, which she abandons at the return of summer, and flies about in search after some commodious ford, or standing water, where she may produce her progeny, which would be soon washed away and lost, by the too rapid motion of any running stream. The little brood are sometimes so numerous, that the very water is tinged according to the colour.

colour of the species, as green, if they be green, and of a sanguine hue, if they be red.

These are circumstances sufficiently extraordinary in the life of this little animal, but it offers something still more curious in the method of its propagation. However similar insects of the gnat kind are in their appearance, yet they differ widely from each other in the manner in which they are brought forth, for some are oviparous, and are produced from eggs, some are viviparous, and come forth in their most perfect form; some are males, and unite with the female; some are females, requiring the impregnation, of the male; some are of neither sex, yet still produce young, without any copulation whatsoever. This is one of the strangest discoveries in all Natural History? A gnat separated from the rest, and inclosed in a glass vessel, with air sufficient to keep it alive, shall produce young, which also, when separated from each other, shall be the parents of a numerous progeny. Thus, down for five or six generations do these extraordinary animals propagate without the use of copulation, without any congress between the male and female, but in the manner of vegetables, the young bursting from the body of their parents, without any previous impregnation. At the sixth generation however, their propagation stops, the gnat no longer produces its like, from itself alone, but it requires the access of the male to give it another succession of fecundity.

The gnat of Europe gives but little uneasiness; it is sometimes heard to hum about our beds at night, and keeps off the approaches of sleep by the apprehension it causes; but it is very different in the ill-peopled regions of America, where the waters stagnate, and the climate is warm, and where they are produced in multitudes beyond expression. The whole air is filled with clouds of those famished insects, and they are found of all sizes, from six inches long, to a minuteness that even requires the microscope to have a distinct perception of them. The warmth of the mid-day-sun is too powerful for their constitutions; but when the evening approaches, neither art nor flight can shield the wretched inhabitants from their attacks, though millions are destroyed, still millions more succeed, and produce unceasing torment. The native Indians, who anoint their bodies with oil, and who have from their infancy been used to their depredations, find them much less inconvenient than those who are newly arrived from Europe; they sleep in their cottages covered all over with thousands of the gnat kind upon their bodies, and yet do not seem to have their slumbers interrupted by their cruel devourers. If a candle happens to be lighted in one of those places, a cloud of insects at once light upon the flame, and extinguish it; they are therefore obliged to keep their candles in glass lanterns; a miserable expedient to prevent an unceasing calamity.

C H A P. XIII.

OF FLIES OF THE GNAT KIND, WHICH HAVE VERY SLENDER SNOOTS OR TRUNKS, LIKE THREADS.

(FROM BROOKES.)

THESE sort of *Flies* are much more troublesome in hot climates, than with us, though in low marshy places, our countrymen have sufficient reason to complain of them; however their bite is not near so painful as those of the Gnats between the *Tropics*: there is one sort in *Peru*, which are called *Muskitoes*, that are so small, they are almost imperceptible, and yet their bite gives a sensation, like the burning of hot iron. Other *Muskitoes* are like our Gnats, and are of two sorts, whose bits are much more painful, and raise large bumps on the skin: they are so numerous, that they darken the air by their multitude, insomuch, that those who travel in the woods are obliged to have a cotton covering, or net, to keep them off, and the poorest *American* is never without one.

Pere du Tertre observes, that in the *Caribbee-Islands*, there are *Flies*, not unlike our common Gnats, and probably are the same as those just mentioned. Whenever they get to the skin, they suck out the blood, and are always bred in marshes and standing waters. At first it is a small worm, not thicker than a hair, and of the length of a grain of corn. After they are changed into Gnats, there are such vast numbers of them, that they darken the air, especially in the morning, two hours before the rising of the sun, and as many after he is set. When any one stops, these little tyrants come buzzing about his ears in such a troublesome manner, that he often loses all patience. If he wants to go to sleep, they fix upon every part of his body that is uncovered, and thrust their small snouts, which are so fine that they can hardly be seen, into the pores of the skin, and as soon as they meet with a vein, they are sure to suck out the blood, and if they are let alone, they will swallow so much, that they can hardly fly after it: the original natives of these islands, make a fire under their beds, that the smoke may drive them away; and even some of the *European* inhabitants, that live in low grounds, and upon the edges of woods, are obliged to make use of a remedy, and even to smoak their houses with burnt tobacco. But the best method to keep them off, is to hang cotton nets round the bed with small meshes; for these small insects, having large wings, are not able to get through them. He also observes, that some *Muskitoes* are no larger than pin points, and yet they always leave purple marks on the skin. However these are only met with on the banks of rivers, where the wind seldom or never blows.

It will not be improper in this place, to take notice of some other *Flies*, common in the *West-Indies*, but not known in *Europe*. One of these is an inch and a half long, and an inch broad: they are also flat, and not much unlike Beetles: they have such hard and strong teeth, that they will gnaw and eat a passage into the heart of the very hardest trees, where they make their nests. Another sort of *Flie* are only seen buzzing

Buzzing on the surface of the earth, immediately after rain, when the sun shines: they are remarkable for the manner of making their nests, which are built with the leaves of trees, which they make of a round figure with their teeth, in such a manner, that of two leaves they form a sort of basket, by laying them one upon another, taking care that there be a hollow space between them, in which they conceal themselves, and lay their eggs.

And now we are speaking of the *West Indies*, this may be as proper a place as any, to take notice of the Hornet-Flie, which is not unlike a Flying stag, a Flie so called, with branched horns like a stag: they have a black small head, covered with orange-coloured hair, as soft as silk: their eyes are round, as clear as crystal, and the size of small peas; and they are so hard, that there is no breaking them, without the help of a hammer: this small head terminates in the shape of a horn, turned up, and armed with four teeth, like the nippers of a cray-fish: this horn is black, as hard and as well polished as jet, and about two inches in length. But the most remarkable thing of all, is its having a joint above the eyes, which has a motion; for the head is covered with a sort of helmet from the head to the wings, where it terminates in another horn, three or four inches long, and bending downwards, reaches the joint of the other, and makes a sort of nippers like those of a cray-fish: this horn is of the same substance as the first, except its being bordered with a short hair, as soft as velvet: they can lift up, or let down the helmet at pleasure; but it is observable, that the males only wear them.

There are two other sorts of *Flies* at *Martinico*, the first of which is horned like the former, only the two horns are of an equal size, and placed on each side the head, though they meet together like nippers, when the insect pleases: these are probably their feelers: the other species is only an inch and a half long, and one broad, and the upper part of their wings are hard, and of a grey colour, only they are striped with silver rays.

The *Walking-Leaf* is an insect brought from the *Spanish West Indies*, and has a very flat body, of a reddish colour, like that of certain dry leaves; that is at some times of the year, for at first it is green. It is produced from a green egg, as big as a coriander seed, from which in a few days proceeds a little black insect, like an Ant when just hatched: the wings are at first like a green leaf, and have fibres run along it, from the inward edges to the outward, much like those of many leaves, and they branch into subdivisions, as they come nearer the edge. On the fore part of the body there are four other small wings, which though they differ among themselves, each pair being of a different shape, yet they exactly resemble some sort of leaves: the larger wings being shut, it exactly resembles a leaf, which has been the reason why it is called the Walking Leaf: the eyes are small and prominent, and the mouth is forked; the head is round, and about the neck there is the resemblance of a ring, of the same colour with the body. Behind this the neck enlarges again, insomuch that it looks almost like another head, but larger. It is above three inches long, and an inch and a half broad. But to return to the Gnats.

Some place the *Tipula* among the Gnats, but improperly, though they cannot be distinguished from each other, without the assistance of

a microscope. *Reaumur* informs us, there are three sorts of Gnats in the fields about *Paris*, the largest of which has a body variegated with white and black, and on the breast there are black and very brown undulations. A lesser kind resembles the former, in the colour of the breast and eyes, but the body is brown: the third kind is less than either, and is most common. It has a light reddish brown breast, and a whitish body; but under the belly, on each ring, there is a brown spot, and the rest is grey; the eyes are of a very fine green.

Gnats in general, have a longish body, nearly in the shape of a cylinder, and it consists of eight rings: the corset, though short, is considerable for its size, and to this the legs and wings are connected, besides the two ballances or mallets: there are also four marks, placed much in the same manner as other Flies; for the two first of which are pretty near the head. When the Gnat is at rest, it generally keeps one of its wings crossed over the other, so as to cover it: the feelers are finer in the males, than in the females, and in several kinds, there are two small longish bodies on the head, of a round shape, which have some resemblance to the feelers of short bodied Flies. *Reaumur* calls them Barbs, because the trunk of the Gnat is placed underneath them; the trunk of the Gnat is a very fine instrument, and is different from that of the Fly, for its sting or prickle, or rather stings, are contained in a sheath. It seems to be designed purposely to bore the skin, and to suck out the blood. *Swammerdam* calls the sting a kind of a reddish shining thread; but *Reaumur* has discovered, that it consists of several threads, which may be divided from each other: the sheath for this seems to be a cylindric pipe, though in reality, it is cloven almost throughout its whole length, and the edges of the cleft recede from each other, when there is occasion.

When a Gnat sucks the blood without disturbance, he seldom quits the place till he has filled his stomach and guts with blood. When the bite of a Gnat is perceived immediately, there is no better remedy to cure it, than to moisten the liquor with water, which is left upon the wound; and this may be easily done, by rubbing in the water immediately; or the wound may be opened a little, and then it needs only be washed. But if the bite is not perceived till several hours after it is done, this remedy will have no effect.

Gnats proceed from a sort of water Worms, that are found neither in rivers nor brooks, but in ponds and splashes of water in marshes, from *May* till the beginning of the winter; for this reason, all marshy places are terribly infested with Gnats, and rainy seasons produce more than dry: the body of the worm is longish, with the head joined to the first ring of the body, by a sort of neck: this ring is thicker and longer than the rest, and seems to be a kind of corset, which is succeeded by eight others; that is, there is nine in all, and they gradually grow less to the end of the tail. It changes to an *Aurelia*, with a whitish body, and a greenish corset, which soon turn brown.

The great Gnat is twice as big as the common Gnat, though it is much of the same shape; for it has a long slender grey body, and large thin transparent wings, without spots: the snout or trunk is prominent and slender, and its sheath is forked at the top, or formed into two leaves, which are hairy, and of the shape of a lance. It is very common about the waters, and while in its worm state, lives in the water.

The humble-bee *Flie* is placed in this class, on account of the structure of its sucker or snout. It is very like a common Humble-bee, in its shape, and even its size, being covered with extremely thick down; its body is short, roundish, and obtuse, and its colour black, but of a reddish-brown on the side: the trunk or sucker is long, which it always carries thrust out, the wings are partly brown, and partly whitish, and a great deal of down on the body is white, which with the blackness below, has a very uncommon effect. It is very common in gardens, where it sucks the honey out of the flowers.

The little *Gnat* is considerably smaller than the common *Gnat*, and has an oblong slender blackish body, with a large head and eyes; the wings are long, narrow, and of a dull white, and three dusky spots near the outer edge. Its bite is attended with pain, and makes a mark that remains for some time. It is common in woods, and about waters.

Linnæus takes notice of six kinds of *Gnats*, namely,

1. The dusky *Gnat* with a forked snout: this *Ray* takes to be the female of the Domestic *Tipula*, because it does not bite or sting. It is of an ash-colour, and twice as large as the following. It has no points on the wings, and from between the jaws there proceeds, or more properly from the trunk, a forked dart.

2. The ash-coloured *Gnat* with eight rings on the body, is the common *Gnat*, which is met with almost in all parts.

3. The *Gnat* with wings of the colour of water, marked with three black spots. Some call it the least *Gnat* with blackish spots, it being no bigger than a small flea, of a brown colour; but the wings are white and narrow, marked on the outer edge with three dark specks. When the wings are shut, it appears like three brown streaks.

4. The black *Gnat* with the wings of the colour of water, black feet, and a white ring: there are prodigious numbers of these in *Lapland*, in the dusk of the evening, and they make a great a noise: they will bite any part, even the eyes, mouth, and nose, and they are not easily driven away. It is very small, is in shape like a common *Flie*, and is of the size of a *Flea*.

5. The downy *Gnat* with wings in part of a dusky colour: this is found in gardens, where they fly about without ceasing, and seem to delight in the smell of the flowers. It is called by *Ray* the *Gnat* shaped like a silk worm *Moth*, all over hairy and black, with a blunt hinder part of the body, and red sides.

6. The black *Gnat* with a dusky body, and a white forehead. In the transactions of *Uppsal*, it is called the blood-sucking least *Flie*, with white wings. It is very troublesome to horses in the summer season, especially in *Northland*, where it gets among the hair and sucks the blood. It is more fond of horses than men, and cannot be driven away: the feelers are like threads, though it is in the shape of a *Flie*; and the head, feet, and breast are black, only on the sides of the breast it is of an ash colour, and there is a white spot above and below the eyes.

C H A P. XIV.

OF FLYING INSECTS OF THE TIPULA KIND.

(FROM BROOKES.)

BY *Tipula* was formerly understood nothing but the Water Spider, of which they knew only two sorts; but now the catalogue is greatly enlarged, and it is plain from *Linnæus*, that other sorts are meant, besides those that frequent the water; though he mentions only seven, namely, the variegated *Tipula*, that of roots, that in the shape of a Gnat, the febrile *Tipula*, that of the Asparagus, that with bended wings, and that of the Juniper-tree. He makes the characteristic of this kind to be the mouth, furnished with crooked and jointed feelers.

That described by *Mouset*, is almost in the shape of a spider, with an oblong slender body, and four legs fixed to the breast. Near the mouth there are two arms, which some take to be feelers, and are most probably really so; for this insect makes no use of them when it runs, and they are twice as short as the other feet. It has four very weak wings, which seem to be of no great use in flying, though they are for leaping: they are shorter than the body, and the upper pair are thicker and broader than the lower, and are of a dusky blackish colour: the lower wings are less, more slender, and of a silver colour: they are often seen leaping upon the water, but so lightly that they seem to make no impression on it at all; however they are not constantly in motion, but by starts. It does not dive into the water, unless forced thereto, and then their bodies do not seem to be at all wet with it. It is to be met with in standing waters, where there is but little wind throughout the summer. It is sometimes met with in rivers, especially near the banks, and under the shade of some tree, as for instance the willow; and there are generally many of them together.

There is an odd sort of a Worm or Caterpillar, which was first taken notice of by *Mairan*, in the memoirs of the Academy of Sciences for 1717, which was afterwards more fully described by *Frych*. It is found in holes near the surface of the ground, about nine inches in length, and in the lower parts the Caterpillar is concealed in a house of its own spinning, and closed at the mouth with the same sort of thread of which the nest is composed. It is of a brownish black colour, with yellow feet, and a shield near the neck; as also another of a black colour on the tail, with a very shining edge. It can hide its head in that about the neck, almost as far as the forehead; and it has twenty folds or furrows on the back, whereas others have generally but ten. It is provided with so great a number, that it may more readily creep into holes, by moving its body more nimbly: this Caterpillar does not make these holes for the sake of food, for there is nothing fit for them there; and if there was, they might get at it without making these holes, because with the head and fore-feet it can quickly throw the earth on each side, so as to be able to hide itself in a very short time. Nor are these holes made for its more speedy return, much less for the sake of breathing;

breathing, for they meet with air enough in whatever place they lye; but the Butterflie which is the dam of this Caterpillar, seeks for a place like all other insects, where there may be iufficient nourishment for its offspring, and there it lays its eggs, by thrusting the sharp part of its belly, which is long and prominent, into the chinks of the earth. These Caterpillars, as soon as they are hatched, presently weave themselves a covering or house, from which it can creep to the most proper place to find food; and by this means it is the better defended from other insects that feed in the same places, particularly from the voracious subterranean Beetles, that wander upon the ground, and yet carefully shun these nests, as Flies do a Spider's web. They first lengthen their hole in proportion to the size of their body, and as the mouture fails, they increase it to above a foot in length, fixing their webs thereto, and lining it, as it were, that it may retain the moisture the longer, and be more strong and firm, and at the bottom of which these Caterpillars generally lye.

The nippers of the mouth with which it eats, are dentated, and generally by night it proceeds from its burrow to the surface of the earth, in search of food, and when it fails, it works its hole to the next place, that the food may be always near it. It grows to the length of a man's thumb, and in *May* its *Aurelia* changes into a Butterfly, which is of a silver shining colour, marked all over with very small black specks, and there are sometimes black marks or spots, which seem to be made up of small specks. The undermost wings are the whitest, and the head is of a dun colour, with feelers on the sides, standing at right angles. The hinder feet are the longest, and are armed with prickles, on account of the roughness of the earth, where it is to lay its eggs.

Insects of this kind of other authors, are,

1. The *Tipula* with whitish wings, and is the most beautiful of this kind; it has a body that is oblong and slender, of a greyish-brown colour, and a cloven tail. The legs are long and slender, the head large, and the eyes like net-work; the wings are large and very beautiful, and they have a brown line running down the outer side, from which proceeds another smaller towards the other side; between these there is a large snow-white spot. It is called by *Ray* the greatest *Tipula* with large wings, variegated with brown and white.

2. The painted *Tipula* has a long slender body, beautifully variegated with a deep glossy black, and a bright yellow, and the breast is also of the same fine black, speckled with yellow. The wings are large and brownish, with dusky veins, and an obscure spot on each, towards the edge; but the legs towards the top, are yellowish. It is called by *Ray*, the beautiful *Tipula* with a black back and shoulders, and a saffron-coloured belly.

3. The *Sea Tipula* is very like a *Gnat*, and has an oblong brown body, with a large beautiful green breast; the feelers of the male are feathery, and of the female shaggy. It proceeds from a long slender bright-red worm, composed of twelve joints. It lives in the sea, in clayey or sandy cases, of a great length.

4. The *Tipula* with wings beautifully variegated with brown.
5. The *Tipula* with whitish wings, with a brown line on the edges.
6. The *Tipula* with whitish wings, with a few white spots.
7. The *Tipula* with grey wings, marked with black lines and spots.

8. The *Tipula* with a black body, black legs, and blue wings.
9. The *Tipula* with grey wings, marked with brown lines and spots, and the belly part blackish on the upper side.
10. The *Tipula* with a grey back and whitish wings, marked with brown spots.
11. The *Tipula* with a black and yellow body, and white wings, marked with faint spots.
12. The *Tipula* with a black body and brown wings.
13. The yellow *Tipula* with a brown back.
14. The *Tipula* with paleish brown wings spotted with black, and a black body.

The following *Tipula* resemble *Gnats*.

1. The brown *Tipula* with the fore part of the body green.
2. The *Tipula* with very large fore legs, formed like feelers, and a white circle on the body.
3. The *Tipula* with the fore legs formed like feelers, and tipped with white.
4. The *Tipula* with white legs, and wings variegated with white and grey.
5. The green *Tipula* with white wings without any spots.
6. The *Tipula* with a yellow body, and black eyes, breast, and back.
7. The black *Tipula* with a bunched breast, and large hind legs.
8. The smooth black *Tipula* with feelers shorter than the head, and with the fore legs furrowed on the inner part.
9. The brown *Tipula* with the base of the wings grey.
10. The oblong hairy *Tipula* with black wings.
11. The black velvet *Tipula*.
12. The *Tipula* with a red body and white wings, black on the outer edge.
13. The *Tipula* with grey bended wings, somewhat oval like the end of a lance.
14. The black *Tipula* with white wings, and a white spot on the fore part of the abdomen.
15. The *Tipula* with blue wings, hairy on the inner edge.
16. The *Tipula* with a reddish body, and a black breast.
17. The *Tipula* with a black head, and the feelers longer than the body, which is of a pale red.

C H A P. XV.

OF CATERPILLARS.

CATERPILLARS are the insects that appear first in the spring, and they proceed from the eggs of Butterflies. Whoever takes a walk in fine weather, will readily find them upon different trees and plants; but their condition is transient, for they all will in a short time become winged insects, and these changes that they undergo, is one of the most singular parts of natural history.

The bodies of Caterpillars are longer than they are round, and they are composed of rings, whose circumference is pretty near circular or oval; they are generally twelve in number, and are all membranous, by which Caterpillars may be distinguished from divers other insects, whose bodies consist of twelve rings. The head of the Caterpillar is connected to the first ring, and between the head and this ring, there is a neck, generally so short, that it is scarcely visible. All the covering of the head in Caterpillars, seem to consist of a shell, and they have neither upper nor lower jaw; for they are both placed exactly at the same height, and armed with such a large thick tooth, that they both are equivalent to all the large teeth that other animals are furnished with. When the mouth is shut, these teeth are always uncovered, so that it is with ease that the Caterpillars cut the leaves in pieces, when they feed upon them.

Caterpillars have six small black grains, placed on the circumference of the fore-ring, and a little to the side of the head. Three of these are larger than the rest, and are convex and transparent; these Mr *Reaumur* takes to be the eyes of the Caterpillar; but *Vaquinieri* will not allow them to be such.

There are a great variety among Caterpillars, one of the most remarkable is, that some have more legs than others, and these are of two kinds; those that are shelly, so called, because they are covered with a sort of shining gristles; and the other membranous, because their skins are soft and flexible. All these Caterpillars have six shelly legs, three on each side, which proceed from the three first rings, and these are called by Mr *Reaumur* the fore legs; but all Caterpillars have not an equal number of membranous legs, for some have two, others four, others six; and others again eight.

Reaumur divides Caterpillars into several classes; the first of which are those that have eight intermediate legs, four on each side; that is to say sixteen in all. Their eight intermediate legs are connected to the four rings that follow each other. The largest Caterpillars, and those that are most commonly seen, are of this first class.

The second and third classes, consist of those that have only three intermediate legs on each side, that is to say, fourteen in all. These are generally remarkable for their industry; and the difference between these two classes, is principally taken from the different arrangement of their feet: the second comprehends Caterpillars that have no feet on the fourth, fifth, sixth, tenth, and eleventh ring; and the third consists of those that have the fourth and fifth ring unprovided with feet, and yet have a pair on the sixth, seventh and eighth, but none on the ninth, tenth, and eleventh.

The fourth class contains *Caterpillars* that have fourteen feet, six of which are shelly, and the eight intermediate ones membranous, placed as in those of the first class, and on the sixth, seventh, eighth, and ninth ring. The fifth class comprehends those that have four intermediate feet, that is twelve in all. In the sixth class he places those that have but two intermediate feet, or ten feet in all.

The *Caterpillars* of the fifth class, have but four rings that follow each other, which have no feet, and those of the sixth class have six rings, which are placed between the scaly legs and the intermediate legs. These two classes comprehend Caterpillars that walk in a differ-

rent manner from the rest; for they proceed as if they were measuring the ground as they go; for which reason they are called surveyors.

The seventh class have no intermediate feet, they having but eight in all, that is six that are shelly, and the two hindermost. Mr *Reaumur* places in this class, the greatest part of Moths, they having only six shelly, and six hinder legs, that is speaking in general, for some have eight intermediate legs. He will not allow any to be Caterpillars, that have not eight legs at least; though *Ray* places in that number, some that have less than eight.

There is a very great difference among Caterpillars, the principal of which is the size and colour. Those of the middle size, are about an inch long, and the diameters of their bodies is little less than a quarter of an inch. Some are only of one colour, others of different colours, some of which are very lively and well determined, others are placed in streaks of different kinds, running sometimes one way, and sometimes another; and sometimes again undulated or spotted. These differences of their colours, and the manner of their being placed, serve to distinguish their kinds; though there are some that are entirely green, and others all over brown.

Caterpillars are also distinguished into those that are naked, and hairy; for the skin of most part of the first kind is soft to the touch, but the others are rough, with hard grains; for which reason, they are called by some shagreened Caterpillars; and several of these have a horn on the eleventh ring, which characterises a distinct kind. Some place these among the naked kind, that are full of round tubercles, and which comprehends most of the large kinds, that produce the most beautiful Butterflies.

The thorny Caterpillars are so called, because they are rough with such hard and thick hair, that they resemble thorns or prickles, exactly like those on plants. The hairy Caterpillars are so very different, some of them being extremely beautiful, and others exceeding ugly, that they may be looked upon as distinct kinds, though they are generally known among us by the name of Palmer Worms.

With regard to the shape of Caterpillars, some are more slender before than behind, and others the contrary. Some are in the shape of fish, and the bodies of others terminate in a kind of fork.

Some Caterpillars when you are about to take them, roll themselves up in rings; and when those that are hairy do the same, they look like small hedge-hogs. Others fall to the ground when the leaves are touched on which they are feeding; and others again endeavour to save themselves by running away.

When Caterpillars are metamorphosed first, they have neither feet, wings, nor motion, nor do they take any nourishment; and then they have the name of a Chrysalis, Nymph, or Aurelia. The Chrysalis which proceeds from the slough of a Caterpillar, is tender and soft at first, but becomes so hard at length, that it is brittle. Some of these Aurelias are all over hairy, and others seem to be shagreened; there are likewise varieties in their shapes, in their sizes, and the arrangement of the prominences on their bodies; they are also of different colours.

The Caterpillar of the apricot-tree is of a purple colour, and marked with red points. It has four tufts of red hair on its back, like the oars of a boat; and there are two more on the head, which make a sort

sort of horns, and one on the tail. It turns to a nocturnal Butterfly, whose female is without wings; and the male is of a red colour, with the wings before marked with a white spot.

The *Caterpillar* of common worm-wood is adorned with a white streak and brown spots. The sides are of a palish green, with brown streaks, and over each joint there is a small white spot on the fore part of the body, six small claws, eight in the middle, and two behind. In *May* they turn to black *Aurelias*, from whence proceed small nocturnal Butterflies, whose head and upper wings are reddish, variegated with streaks and spots that are black and brown. There is also a small white spot that shines like silver in the middle on the upper wings, but the lower are brown. These Butterflies have small black horns, and two shining eyes; they fly only in the evening.

The same plant nourishes a small long greenish *Caterpillar*, which has a remarkable walk; for it joins the hind part of the body to that before, making a sort of hump, and proceeds forward in that manner. About the end of *July* these *Caterpillars* turn to *Aurelias*, and fourteen days afterwards small nocturnal Butterflies come out, whose head, body, and upper wings, are adorned with green, and variegated with white, black, and brown spots and streaks; but the lower wings are of a bright brown. They have also two small horns of a bright brown, and four little feet spotted with brown; and they fly very swiftly.

Albin and *Lister* speak of another *Caterpillar* that feeds on wormwood, which is of an olive colour, inclining to brown, which changes in *July* to an *Aurelia*, and becomes a nocturnal Butterfly in *September*. *Goedard* also speaks of a *Caterpillar* that feeds on the leaves of wormwood, and which changes into the Solitary Fly. The same authors also mention another sort of *Caterpillar* that feeds upon the leaves of sea-wormwood, and which changes into a most beautiful Butterfly, which will be hereafter described.

The *Caterpillar* found upon ever-green privet, is a beautiful insect, being of a dark purple mixed with red and brown. It changes to an *Aurelia* in *May*, and in *July* becomes a fine red nocturnal Butterfly, whose upper and lower wings are crossed with black lines.

The *Caterpillar* of marsh mallows, becomes a reddish nocturnal Butterfly. There is also a small white insect, spotted with black, which feeds upon this plant, which changes into a small winged animal that leaps like a Flea.

The pine-apple *Caterpillar*, is of a greenish colour, with a red and white streak running through the length of the body. It becomes a Butterfly, which beheld through a microscope, seems to have the wings covered with scales, like those of a fish, each of which has three teeth, with some very long hairs; and they are disposed in such a manner, that they may be very easily counted. The whole body seems to be covered with a sort of feathers mixed with hairs.

The *Caterpillar* of the columbines is small, and feeds on the flowers of this plant, turning afterwards to a small black Fly. There is likewise another *Caterpillar* belonging to the columbines, that rolls itself up like a ball. It hides itself in the earth before it undergoes its change, and two Flies have been seen to come out of the *Aurelia*.

The *Caterpillar* of the tree called Areck, is very large, and is to be met with under the branches of this foreign tree. It feeds on the flowers

ers and the fruit, and becomes a fine Butterfly, the upper part of whose wings are black, and beneath of a golden colour, bordered, spotted, and streaked with black. The back of the Butterfly is adorned with small red specks.

The meadow pink *Caterpillar*, is of a bright brown colour, mixed with black and white spots. It gets into the earth before it is changed to an *Aurelia*, and in the month of *June* becomes a nocturnal Butterfly, with yellow under wings.

The *Arrach Caterpillar* becomes a small red nocturnal Butterfly in *June*; and it is of a blue-green; but the Butterfly is of a bright brown.

Wild *Arrach* feeds several sorts of *Caterpillars*; for *Merian* speaks of a *Caterpillar* of a bright green, that feeds on the leaves of this plant. She continues in the same state till *August*, when she is transformed to a brown *Aurelia*, and on the following night the *Butterfly* proceeds therefrom, of the colour of a faded leaf. There is another *Caterpillar* belonging to this plant, of a blueish green, which is very slow, and changes her skin four times, assuming a new one as she quits the old. On the fourth of *September* one of these produced a maggot, that was in continual agitation, which continued for fourteen hours, and then she appeared of a dusky pale colour. She continued in this condition till the 26th of *September*, and then a *Flie* came out, of a common form, with long feet, flat at the end, and a large head. She died on the third of *October*. *Allbin* speaks of another belonging to the *garden-arrach*, which continued feeding till *September*, and then she hid herself in the earth, and did not turn to an *Aurelia* till *July* following; from whence proceeded a nocturnal *Butterfly*, of the colour of a faded leaf.

The *Caterpillar* of *Jerusalem artichokes* is of a brown colour, with a yellow belly, with an ash-coloured line that parts the brown from the yellow. She likewise feeds upon other plants, and does a great deal of damage in gardens. She changes into a *Butterfly* with yellow wings spotted with black. *Goedard* speaks of another *Caterpillar*, that feeds upon the leaves of this plant, and produces a *Butterfly* with wings as white as snow, and a body of a light yellowish colour. This *Butterfly* flies about, and is fond of liberty. The same plant nourishes a hairy *Caterpillar*, that was observed to change her skin the 13th of *August*, and on the sixth of *September* she began to feed again. She began to change on the 10th of the same month, but the metamorphosis was not changed again till the ninth of *May* following, and then it became a white *Butterfly*.

The *Caterpillar* of the white thorn, is of several colours, and also feeds upon the leaves of fruit-trees. It spins a grey cocoon, and changes into a brown *Aurelia*. When touched it rolls itself up, and a white nocturnal *Butterfly* proceeds from it, that dies after laying yellow eggs.

The *Caterpillar* of the alder-tree is white, variegated with white streaks and spots; the head is black, and on the fore part of the body there are six feet, in the middle twelve, and behind two, that are small. Towards the end of *June*, it changes into an *Aurelia*, that becomes a white nocturnal *Butterfly* fourteen days afterwards, spotted with black. This tree feeds several other *Butterflies*, one of which has two hooks, of a yellow colour, and so is the rest of the body, with a mixture of flame colour. A *Butterfly* proceeds from hence, variegated with divers colours,

colours. Another of these is hairy, and of a green colour. In *October* it begins to change, and at the end of *June* in the following year, it turns to a dusky Butterfly, spotted with white. Another Caterpillar again is green, and produces a very beautiful Butterfly, variegated with several colours.

The *Caterpillar* of the *Ballia*, a plant of *Surinam*, is of two kinds; the first is yellow and white, with black streaks, and turns to a nocturnal Butterfly, with black spots: the other is yellow, striped with black, with a brown head, that turns to a small Butterfly of an oker colour.

The *bananoe Caterpillar* is of a brown colour, and the back is armed with four prickles: the tail is cloven to the feet, is red, and the head seems to be adorned with a crown. It changes to a Butterfly, called the *little Atlas*. It breeds another *Butterfie* of a bright green, which in *May* turns to a nocturnal *Butterfly*.

The *venelloe Caterpillar* is brown, striped with yellow, and turns to a fine *Butterfly*, the under part of which is of a saffron colour, and the upper variegated with yellow, red, and brown, and silver spots. A green *Caterpillar* of the same plant, turns to an ash-coloured *Butterfly*.

The *burdock Caterpillar* is brown on the back, spotted with black, and under the belly it is of a pale yellow. On the fore part of the body there are six small feet, and in the middle there are eight. In *June* it turns to an *Aurelia*, of the colour of silk, from whence proceeds in *July* a small nocturnal *Butterfly*, with the head and upper wings of the colour of silk, variegated with brown and golden spots. It has six brown feet, and flies only in the evening.

The *potatoe Caterpillar* is of a square shape, and a greenish-yellow colour, covered with small round red studs. It turns to a brown winged insect, streaked with a yellow golden colour: there are other *Caterpillars* belonging to this plant, of a green colour, which become white and yellow *Butterflies*, whose wings are bordered with brown.

The *low parsnip Caterpillar* is of a bright green colour and changes to an *Aurelia*, that turns to a *Butterfly*, of a dusky olive colour.

The *corn Caterpillar* is usually met with in corn fields, and feeds upon the roots of tares. It is of a bright brown colour, streaked and spotted with one that is darker. In *September* it turns to a nocturnal *Butterfly*, with the fore part of the body and the wings of a greyish ash-colour, adorned with black, and on the wings there may be plainly seen the *Roman* letters *B.C.V.M.* on the fore part of the head there is a long brown snout, which is divided into two parts at the end, each of which is moveable every way: the hinder part of the body is of a bright red, streaked with black, and there is another streak of a greyish ash-colour: the middle of the body is hairy, and it flies in the night, making a buzzing with its wings.

The *grass Caterpillar* is adorned with small black streaks, and has the head and hinder joint of the same colour. It casts its skin six times, and then changes to a bright brown *Aurelia*, which in the month of *August* turns to a nocturnal *Butterfly*, with the head and upper wings brown, adorned with black. It has six black horns, and the hinder part of the body, and lower wings, are of a greyish ash-colour.

The *birch Caterpillar* often lyes upon the leaves in a semi-circle, and it spins a white web, changing into an *Aurelia*, of a bright brown colour;

hour ; from whence proceeds a small nocturnal Butterfly, spotted with a light colour and brown.

The burrage *Caterpillar* is of a green colour, with six small feet before, and four behind. It also feeds upon collyflowers in *August*, and spins a white web, after which it changes into an *Aurelia* of different colours, some of which are brown, and others of a dark green. From these last proceed insects of a black colour, that fly like *Wasps*, having yellow feet, and transparent wings. From the black *Aurelias* proceed small Nocturnal Butterflies, variegated with black streaks, and long black spots : there is another burrage *Caterpillar*, that spins a very fine web, wherein it continues till *March* the next year, and then changes to a bright brown *Aurelia*, from whence in *April* proceeds a nocturnal Butterfly, variegated with black and white streaks and spots. It has two little grey horns, and four small feet.

The bramble *Caterpillar* becomes a nocturnal Butterlfy ; and there is another that is black, spotted with orange, that changes to a Butterfly streaked with grey.

The chocolate plant *Caterpillar* feeds on the leaves of that tree, and is black streaked with red ; and the streaks are speckled with white. It changes to a nocturnal Butterfly, variegated with black streaks and spots : there is another large *Caterpillar* that feeds on the leaves of the same plant, and has a body covered with green and yellow sharp hair.

It is very venomous, and becomes a nocturnal Butterfly, of a rose colour, with wings spotted with white underneath, and bordered with black ; and in the middle there are two black spots, the one large, and the other small and triangular : there is another belonging to this plant, with little or no hair, of various colours ; and over all the body there are black lines and circles. It becomes a very beautiful Flie, variegated with grey, sea-green, and silvery spots.

The *Caterpillar* of the rennet, an herb so called in *America*, has a body marked with several round raised white specks, and on each of its sides there is a white streak. On the hinder part of the body there is a horn, half white and half blue, with six small feet before, eight in the middle and two behind, of a flesh colour. In *July* they turn to *Aurelias*, which in *August* change to small Butterflies, whose head, fore part of the body, and upper wings are brown, with dark specks ; but the hinder part is white, adorned with transverse streaks, and small black hair : the lower wings are of an orange-colour, and the eyes are black, with small black horns ; and it has a trunk for the sucking of flowers. It flies so swift by day, that it is hard to be caught.

The green *Caterpillar* described by *Albin*, is spotted with black, and near the head, on each side the body, there are spots like eyes ; and there is a kind of black horn on the head. When this *Caterpillar* has done feeding, it draws in its head like a sea-turtle.

The elephant *Caterpillar*, so called, because it has a sort of a trunk, is of a dark brown colour, with rings and lines on the body, of a brighter brown. It has a kind of a horn, like the former, which is placed on the tail. It changes to a very beautiful nocturnal Butterfly, of an olive green colour, mixed with that of rose.

The calamint *Caterpillar*, often becomes a prey to the Titmouse, that bird being very fond of it. It is always slimy like a snail, leaving a mark behind it. It is very fearful, and hides itself in the leaves of the plant,

on which it feeds, which is always by night. In *October* it builds a cell with dirt and sand, and in *March* it turns to a *Butterfly*, beautifully variegated.

The rampions *Caterpillar*, does not change into an *aurelia* till the following year, when it becomes a small *Butterfly*.

The acajou *Caterpillar* is a native of *Surinam*, and is hairy, and as white as snow, which in *March* turns to a transparent *Butterfly*. There is another of a red colour, belonging to the same plant, which turns to a *Butterfly* of the colour of wood.

The cassava *Caterpillar* is large and black, with the hinder part of the head as red as blood. These *Caterpillars* do prodigious mischief among the plants called cassava, of which the inhabitants make bread. They change to nocturnal *Butterflies*, beautifully variegated with black and white, and the upper part of the body is spotted with orange.

The chervil *Caterpillar* is of a shining green, streaked with white. It spins a slender cod, and becomes a chestnut coloured *aurelia*, which in fourteen days turns to a nocturnal *Butterfly*.

The *Caterpillars* of cherry-trees, are of different kinds, that is, as many as there are different sorts of cherries. That on the cherry-trees with double blossoms, when it is ready to be metamorphosed, spins an oval cod, which shines like silver, and as stiff as parchment. It turns to a nocturnal *Butterfly*.

The rough cherry-tree feeds two sorts of *Caterpillars*; the first is brown, and rolls up the leaves, in which it encloses itself. It creeps very swiftly, as well backwards as forwards, and when it is touched, it descends to the ground by a thread drawn from its mouth. It spins a white cod, which turns to a brown *aurelia*, and in *October* it turns to a *Butterfly*, of a bright brown. The second *Caterpillar* is yellowish, and rolls itself up in green leaves. It descends to the earth like the former, and gets up again by the thread as swiftly. It spins a white cod, which in *October* is metamorphosed to a *Butterfly*, of a bright brown.

The great cherry-tree with sweet fruit, likewise nourishes beautiful *Caterpillars*; there are streaks that run cross the back, which seem to be bordered with pearls. In *July* they spin a cod, which shines like silver; which changes to an *aurelia*, from whence in *August* proceed beautiful nocturnal *Butterflies*, variegated with black, white, and grey, orange, and rose-colours. It feeds another *Caterpillar* of a sea-green colour, which changes into an *aurelia* in the beginning of *August*, which at the end of the same month turns into a *Butterfly*. There is also another, which is long, and of a yellowish green, it changes to a small nocturnal *Butterfly*, whose lower wings are brown, and the upper green, as well as the body, which is adorned with white spots, and small brown points. *Albin* takes notice of two *Caterpillars* of different colours, found upon cherry-tree leaves. One is yellow, marked with lines of a deeper yellow, and on each ring there are red spots. They have both red heads, but the ring on the neck is yellow. They retreat under ground, where they first become *aurelias*, and then nocturnal *Butterflies*, and lay their eggs in the chinks of trees. Some call them *Loopers*, because they bend their bodies in such a manner, as to make a loop.

Geodard speaks of another that feeds upon cherry-tree leaves, one of which began to change to an aurelia on the sixth of *June*, and on the fourteenth of the same month, it became a Butterfly, of a very odd colour; for it seemed to be cloathed with a patched garment, and the neck was like a piece of cloth, made up of a mixture of white and black.

The Caterpillar of our ladies thistle, are of several kinds, some of which become small black Flies, and others beautiful little Butterflies. Goedard speaks of one covered with down, and very fearful, that cannot bear cold nights. It is blackish, with prickles on the back of the same colour, only they are a little yellow at the points.

The beech Caterpillar is of a yellow colour, variegated with black spots and streaks, and having on the fore part of the body six black feet, eight in the middle, and two yellow ones behind. It is very slow, and stands stock still when touched. It produces a small nocturnal coloured Butterfly, whose spots on the upper part are crossed with others that are red, that shine very much, and the lower wings are spotted with red. It seldom flies, but keeps among the grass and on the flowers; the eggs are yellow.

The oak Caterpillar is striped with yellow and green, and when it casts its skin, it becomes brown; likewise when it casts its skin again, it becomes of a dark red. It feeds on oak leaves till *September*, and then turns to a brown aurelia, which in *December* is changed to a brown nocturnal Butterfly, spotted with yellow and white.

Albin takes notice of several oak Caterpillars, one of which is yellow, with a black angular line, running along the back. It changes to a beautiful nocturnal Butterfly, whose upper wings are of a gold colour, and the belly and lower wings of the colour of cream, clouded with gold and rose colours. Another is of a bright yellow, with reddish spots, and several points on the tail. It wraps itself up in the oak leaves, and in *September* it turns to an aurelia, which in *April* becomes a nocturnal Butterfly, with a back and upper wings of a pale green, and the inner side of the edges of a scarlet colour.

The same author speaks of another, which changes its skin twice, and then becomes of a bright brown, inclining to an ash-colour, and afterwards to a nocturnal Butterfly, variegated with white and black. Another oak Caterpillar is of a bright brown; another of a pale red, a third green, and a fourth yellow. This last is of an extraordinary shape, which in *June* becomes a butterfly, whose surface is of a dark brown, and seems to be laid on a purplish blue.

Redi acquaints us, that on the twelfth of *July* an oak branch was brought to him, on whose leaves were above thirty Caterpillars, placed in a regular order: they were clothed with white short hair, and their bodies were speckled with several colours, as yellow, orange, grey, and black: they had a yellowish crescent on the head, which was of a shining chestnut colour: they seemed to be all motionless, and were put into a large box, where in two days time they cast their skins, and began to eat oak leaves; they continued to feed till the twenty second of the same month, when they retired to the corner of the box, and became motionless again: they continued so two days, and then cast their skin a second time, after which they became lively, their bodies being larger, and their hairs more long: they fed very greedily till the first of *August*, when they left off, became weak and small, and their hair

hair fell off. In short they seemed extremely sick and weak, and continued so till the fourth of *August*, when six of them cast their skins a third time, and became black aurelias, and looked like children in swadling cloaths. The next day in half an hour's time, they turned to Butterflies, but laid their eggs soon after, to the number of forty, which were of a pale blue, and had a little black speck in the middle.

The honey-suckle Caterpillar, in *August* turns to an aurelia, which does not change to a Butterfly till *June* the next year. There are other Caterpillars of this plant, that become Flies.

The dog-grass Caterpillar in *July* spins a green web, and turns to a grey aurelia, from whence a Butterfly proceeds in *August*, of a dark orange-colour, that lays green eggs.

The cabbage Caterpillar does a great deal of mischief among those plants, in dry seasons, but it is killed by the rain. It casts its skin twice a year, and turns to a white Butterfly. It is of a pale green spotted with black, and on the back there is a yellow spot or streak; but the belly is marked with small yellow specks. It turns to an aurelia in *September*, and in *April* turns to the white common Butterfly.

When cabbages are young and tender, they are devoured by a Caterpillar of a meadow-green colour, with a yellow streak running along the back, and on both sides of each joint there is a small yellow speck. When it arrives at its full growth it turns to a pale brown aurelia, spotted with black, and fourteen days after it changes to a small Butterfly. *Albin* speaks of a green cabbage Butterfly, with a yellow line on each side, which he found on a cabbage-leaf in *June*, that turned to an Aurelia in *July*, and in the same month became the great common white Butterfly.

The colly-flower breeds a yellow Caterpillar spotted with green and black, and it devours the leaves, leaving nothing but the ribs. *Goedard* affirms, he has known some colly-flower Caterpillars turn to very ugly Butterflies, and others to Flies. *Redi* gathered great numbers of the cabbage Butterflies, that were of a greenish colour, marked with white and black, and put them in boxes. In four days time, they all became immoveable, after they were fixed to the top of the box. They left small yellow eggs behind them, which in *March* following, turned to small blackish Flies. *Valisnieri* discovered that these were very small silken cords, made by small insects that feed on the bodies of the Caterpillars. The above Caterpillars stuck to the box by the means of a silken thread which came from the extremities of their tails; there were also two other threads on their shoulders, and a fourth that proceeded from the under part of the mouth. They lay all the winter in this condition, but in *March* they left their skins sticking to the box, and came out in the form of Butterflies, of a bluish-green colour, with two black round spots on the upper wings, and two small yellow horns on the head.

The Caterpillar of the citron-tree, is of a beautiful yellow, but red towards the belly; on the tail there is a double streak in the shape of a flame. Its thread is a kind of silk, more shining, and in greater abundance than that of Silk-worms; and if these Caterpillars were common, they would yield more silk than Silk-worms themselves. It becomes a very large nocturnal Butterfly, of a red and golden colour, with white streaks on all the wings, on each of which there is a bright

transparent spot, that is surrounded by two circles, the one within, and the other without; one of which is white, and the other black.

Merian speaks of another insect that feeds upon citron-leaves, which is quite different from a Caterpillar, and its feet are covered with a skin, with which it adheres thereto. This is a very numerous insect, for when it touches the skin, it certainly inflames it; however it changes to a beautiful nocturnal Butterfly.

The leaves of the hazel-tree feed *Caterpillars* of different kinds, one of which is of a saffron colour, and turns to a nocturnal white Butterfly, streaked and variegated with brown spots. *Ray* mentions the great hairy Caterpillar, with thick tufts of hair, or pencils of a red colour, that feeds upon the leaves of this tree. It is of a yellowish-green, and produces a small green Butterfly. *Albin* gives the figure of a monstrous Caterpillar, which according to *Aldrovandus*, is of a middle nature, between a Caterpillar and a Spider. *Albin* has another beautiful Caterpillar, of a grey colour, variegated with black specks on the back. It retires into the ground before it turns to an *aurelia*, and afterwards becomes a nocturnal Butterfly. Another turns to a nocturnal Butterfly with wings furrowed like a cockle-shell. There is also a green Caterpillar, which turns to a Butterfly, nearly of the same colour.

The *Caterpillar* found on the leaves of garden-cresses, are black on the back and white under the belly. It has six black feet before, and eighteen behind, that is nine on each side. In *June* it spins a slender coc, and changes to a brown *aurelia*, from whence a nocturnal Butterfly proceeds soon after, spotted with brown.

The sea-green *Caterpillar* feeds on the herb by some called the peacock's crest, and changes to a nocturnal Butterfly, of an ash-colour, that feeds on the honey of flowers.

The dandelion *Caterpillar* is of a brown colour, and has two sorts of hairy horns on its head. And on the back there are five small tufts of hairs, but all the rest of the body is covered with yellow hair. In *May* it produces a grey Butterfly.

The *Caterpillar* of the sleeper, a plant so called by the *French* in *America*, is green, striped with rose colour and it has two small horns. It changes into a brown Butterfly, variegated with yellow.

The eglantine *Caterpillar* is very slow and idle, for it will sooner suffer itself to be crushed to pieces, than run away. It turns to an *aurelia* in *September*, and in *May* following it turns to a beautiful Butterfly.

There are several *Caterpillars* that feed on the *white thorn*, one of which has a gilded back, and changes into a *Chrysalis*, which becomes a Butterfly, with black veins. It is of the colour and shape of the large cabbage Butterfly: there is another spotted with white on the sides, and the furrows between the legs are black; but the rest of the body is of a brownish black; this turns to a nocturnal brown in the middle of the wings, and two white spots on the upper wings. There is a third black Caterpillar, with brown spots, and the rings of a saffron colour. It becomes an *aurelia* in *May*, and in *August* a nocturnal Butterfly, of a bright grey colour. There are several others, one of which is beautifully variegated with different colours, and becomes a nocturnal yellow Butterfly, with different spots. Another is brown, and the Butterfly it changes to is partly red, and partly yellow. A third is of

• a dusky colour, with a red head, and turns to a nocturnal Butterfly of a bright yellow colour, with darker shades, and spots of the same. A fourth is of a sea-green colour, and the upper wings of the Butterfly are of a bright brown, and the lower of a bright yellow. A fifth is green, and turns to a nocturnal Butterfly, of a greenish blue. A sixth is of a blackish brown, and is metamorphosed to a white nocturnal Butterfly. A seventh is of a deep black, with spots of different colours, and the Butterfly is of a dirty grey; and a ninth is green, which turns to a nocturnal yellow Butterfly.

Goedard speaks of one that feeds upon the leaves of the white thorn, and hides itself under them, to avoid the heat of the sun. He had one of these that cast his skin three times; but on the twelfth of *June* turned to an aurelia, which produced on the fourth of *July* a beautiful white Butterfly.

The barberry-bush *Caterpillar* is of a golden colour, with a black head, on which the *Ichneumon Flie* lays its eggs, which become worms, that feed on these sort of *Caterpillars*. There is another with a green back and yellow belly, from whence proceeds a brown Butterfly. There is another of a blackish brown, with red spots, which changes to a white nocturnal Butterfly, whose upper wings are spotted with black.

The maple *Caterpillar* is of a dark brown, and turns to a beautiful yellow Butterfly.

The fennel *Caterpillar* is green, with streaks as black as velvet, and spotted with orange, and feelers of the same colour. It turns to a green aurelia, and then to a beautiful Butterfly, of a yellow colour variegated with black.

The *Caterpillar* of the sweet bean plant of Surinam, is covered with black and yellow hair, and turns to a *Flie*, with brown wings, and the body is spotted with red, green, gold and silver colours. On the same plant there is a white Butterfly, armed with black points at the back, and the feet are likewise black. It afterwards turns to a beautiful Butterfly.

The fig *Caterpillar* is at first green, striped with yellow, and afterwards orange, with red streaks all over the body, but the head and tail are black. It turns to a brown nocturnal Butterfly.

There is also a large *Caterpillar*, mottled with various colours, that feeds on the leaves of the fig-tree, and has two orange-coloured horns, which are venomous, and cause sharp pain. It becomes a nocturnal Butterfly, variegated with dark brown, green, and silver colours. There is also a green *Caterpillar* belonging to this tree, striped with white, which changes to a nocturnal Butterfly, variegated with yellow, white, and grey.

The raspberry-bush *Caterpillar* becomes a brown Butterfly, whose wings have a whitish round spot in the middle.

The ash-tree *Caterpillar* rolls itself up under the leaves, to shelter itself from the heat of the sun. One of these was observed to be metamorphosed into an aurelia on the twenty-fourth of *June*, and to become a sort of a Moth the twenty-sixth of *September*. The black Cray-fish, is a *Caterpillar*, so called, belonging to this tree, because the hinder part in some sense, resembles a Cray-fish; but the fore-part is like a snail, and it is all over black. It turns to a grey *Flie*.

The fern Caterpillar is of a beautiful bright green, and changes to a nocturnal Butterfly, of a bright brown, whose upper wings are brown and white.

The Caterpillar of the German broom, is green, with a black stripe running along the back, and under it on each side, there is a white stripe. It spins a web in the middle of June, with meshes like a net, and at the beginning of July it changes to a small nocturnal Butterfly, of a bright green. The wings are marked with transverse white streaks, inclining to green, and it flies very swiftly. There is another Caterpillar belonging to this shrub, which is black, and on each joint there are two small blue spots, adorned with a tuft of hair. The head, and all the feet, are of an oaker colour. At the end of June, it spins a grey web, and turns to a brown aurelia, with a head covered with black hair. In the middle of July it becomes a nocturnal Butterfly, of a dark yellow colour, streaked with brown, and the horns resemble feathers.

The gum-gutta Caterpillar is very large, and streaked with green and black; it feeds on the leaves of this plant, and becomes a stately Butterfly.

The grass Caterpillar is of a bright green, and on each side of the body before, there are six small feet, eight in the middle, and two behind. It turns to a green aurelia, from whence proceeds a small beautiful Butterfly, variegated with brown and black stripes and spots. It has two small horns, spotted with white and black, and two fine green eyes. It flies very swiftly. There are other Caterpillars belonging to the different sorts of grass; one of which is of a bright brown, spotted with black and yellow. It sleeps by day, and by night is in continual motion.

Another is green, and changes to what is called the brown meadow Butterfly. Another again is yellow, with a brown head, and changes to a nocturnal Butterfly, called the Wood Leopard. On the grass of marshes there are two, one of which is of a dark red, and changes to a nocturnal Butterfly or Moth, and the other green, changing to a nocturnal Butterfly, of a reddish colour.

Merian takes notice of a large brown Caterpillar, that feeds upon common grass, which is variegated with yellow and white, and has a small tuft of black hair on the head, on the tail there is a prickle resembling a small horn, and on each side there are small tufts of white hair that cover the legs. It delights in moist places, and in the middle of June spins a yellowish coc, from whence proceeds a nocturnal Butterfly or Moth, at the end of the month. It is of a faded yellow colour, and across each wing there is a brown streak, with two white spots, and a narrow border of brown. It lays white eggs.

The grenadier Caterpillar feeds upon a plant so called, in Surinam. It is of a yellow colour, and in May turns to a fine Butterfly, of a blueish silver colour, bordered with a brown stripe, marked with white half-moons; but underneath it is brown, spotted with yellow. It appears through a microscope to be covered with blue tiles, like those that cover houses. The largest feathers are ranged in a beautiful order on the wing, and look like those of a peacock's tail, being very brilliant.

The Caterpillar of the white gooseberry-bush, has a grey body, with a black stripe on the back: they are hairy, and the head is yellow. Behind

Behind the head on each side, there are five blue specks, and others along the body that are red. In *August* they turn to a bright brown *Aurelia*, and from it in *September* there proceeds a nocturnal *Butterfly* or *Moth*, streaked with white, yellow, and black.

On the common gooseberry-bush there is a *Caterpillar*, yellowish on the fore part, and on the hinder white above, and yellow below: the *Aurelia* resembles a child in swaddling-cloaths, which shine with gold and silver. At the end of *June* it turns to a *Butterfly*, whose upper part is spotted with a deep yellow and brown, and the under adorned with black spots.

On the prickly gooseberry-bush there is a brown *Caterpillar*, in *April*, streaked with black, and spotted with white. In *June* it spins an oval coc, of a dark yellow, and turns to a brown *aurelia*; and the *Moth* that proceeds from it has a white spot on each wing: there is another green *Caterpillar* on the same plant, that sticks so close to the leaves, that it cannot be taken off without hurting it. In *May* it turns to a brown *aurelia*, and fourteen days afterwards to a white and brown *Butterfly*, with several spots.

The red gooseberry-bush feeds a sort of grey *Caterpillar*, which in *December* changes to a chefnut-coloured *aurelia*, and in *February* to a white *Moth*, streaked with black, and that lays greenish eggs.

Albin mentions a whitish-yellow *Caterpillar* variegated with black and red spots, that hides itself in the ground, where it changes to a red *aurelia*, and becomes a nocturnal black and white *Butterfly*, mixed with yellow. This *Caterpillar* has been found on the gooseberry-bush, and is called by *Ray* the middle-sized *Phalæna*, with large wings, marked with many black and white spots, and yellow, transverse, variegated lines.

Merian takes notice of the *Caterpillar* that feeds on the red gooseberry bush, which differs from others, in not having the feet in the middle of the body, but at the extremity. It changes to an *aurelia* the first of *April*, and turns to a fine *Butterfly* the latter end of *June*; but it is too weak to live long. *Goedard* says he has met with one that turns to a grey *Flie*, and lives but four days, and there is another that becomes a black and yellow *Flie*.

Goedard has observed another on this bush, that feeds on small insects; that run about its body; it turned to an *aurelia* the ninth of *June*, and on the thirtieth it became a *Flie*.

The guava *Caterpillar* of Surinam, is green, with six white streaks on each side, and a black round spot on each joint. On the hinder part it had a red horn, and became a nocturnal *Butterfly*, with ashen-coloured wings, marbled with white and black. The body was marked

with ten orange-coloured spots, and on the head there was a long red trunk, which it made use of for the sucking of flowers. There are other *Caterpillars* on the same tree, that are covered with hair, on some white, and on others red. They are all venomous, and when touched, they cause a swelling, with pain. They have four feet, and turn to ugly small *Flies*.

He also mentions another sort, with a black head and back, that turn white by little and little, and afterwards become of a fine yellow. The fore and hind parts are covered with black hair; but that under

the belly is brown. It becomes a nocturnal Butterfly, with a white body, spotted with a yellowish brown.

He likewise takes notice of a large dark brown *Caterpillar*, with a black streak from the head to the tail, and black rings round the body. On the belly there are small white specks, and the head and tail are of a purple colour. It becomes a large nocturnal Butterfly, with a white streak on its body, and four black spots on each side, besides four black oblique lines, and four others that are white. The upper wings are spotted with white and brown, and the lower are yellow above, and dark brown below.

The purple *Caterpillar* feeds on all sorts of herbs, but more particularly pinks. They are of a brownish-purple above, and of a bright yellow below; in *August* they change to *aurelias*, and fourteen days after to Moths. The black *Caterpillar* feeds on all sorts of herbs and leaves, and rolls itself up when touched; it turns to a *Butterfly*, spotted with black in three different places.

The hop *Caterpillar* has half the back and belly of a tawny colour, and the other half white. It turns to an *aurelia* in *August*, and towards the end of the same month, becomes a dark red *Butterfly*. *Ray* calls it the *Butterfly* like that of the *Elm*, but less, with laciniated wings, and the lowermost marked with a crooked black line.

The *hyssop Caterpillar* is found on that plant, when it is in flower. When a leaf is touched, it throws itself down, and gets into the earth. It changes its form in *August*, and three days after there proceeds from the skin three small worms, which change in a short time to eggs, and then to *Flies* in *September*; but they live only three days.

The knap-weed *Caterpillar* is found on the flowers of this plant, and is of a brown colour, and hairy. It spins itself a *cod*, which turns black, and in *March* following changes to a white *Moth*, streaked and spotted with black. *Albin* acquaints us, that there is another *Caterpillar* which feeds on the leaves that turns to a *Moth*, of a deep brown colour, with a mixture of dirty grey on the wings.

The *Caterpillar* of the oriental *hyacinth*, is black, hairy, and very nimble; but when touched, it rolls itself up. It spins a *cod*, which turns to a black *aurelia*, and fourteen days after to a *Moth*, with brown upper wings, and the lower of a pale red, spotted with black. It is found in *Surinam*.

The *rag-wort Caterpillar* is of two kinds, the first of which is of a citron-colour, with black wings, and changes to a red and black *Moth*. Small worms proceed from its body, which turn to *Ichneumon Flies*. The other is an autumnal *Caterpillar* like the former, but how it changes is not known.

The *java Caterpillar* is large and white, streaked with black. On each side there are five shining specks, of a red colour, which some take to be eyes. It turns to a *Moth*, striped with black and white. There is another green *Caterpillar*, that feeds on the same leaves, and becomes a transparent *Butterfly* spotted with black.

The *crowned Caterpillar* feeds on the leaves of the *Indian jessamin*, and becomes a fine undulated *Butterfly*, with six white spots on the wings, whose under parts are red and black. There is a *Caterpillar* on the common *jessamin*, of a green colour, with red stripes, but they are very uncommon, as *Albin* acquaints us.

The *Caterpillar* of the sea bull-rush, is a very slow insect, and on the second of *June* there was a worm observed to proceed from the hinder part of its body, which on the twelfth became a very small *Flie*. This *Caterpillar* turned to an *aurelia* the fifth of *June*, and on the first of *August* became a *Flie*, with wings so close to its body, they can scarcely be seen.

The *Caterpillar* of the garden *iris*, with large leaves, is green, and very swift; it changes to an *aurelia* in *October*, and in *March* following, to a brown moth, with a white spot on each wing. There are also blueish *Caterpillars* on this plant, which in *September* turn to bright coloured moths. *Merian* affirms, he has found a green *Caterpillar* at the roots of the *iris*, which in *June* turns to a grey moth.

The *Caterpillar* of the dame violets, is a long slender insect, which when it creeps, turns up its tail near the head. It changes in *May* to a grey *aurelia*, which in *June* becomes a fine *Butterfly*, with the head, lower wings, horns, and feet, of a bright yellow; and the eyes are black. *Merian* mentions a green *Butterfly*, of the same plant, with a black head, and six feet before, six in the middle, and two behind. At the end of *April* it spins a yellow web, which turns to a green *aurelia*, spotted with black, from whence a white *Butterfly* proceeds in *May*, that can scaree fly from one flower to another.

The *Caterpillar* of the sow thistle has the upper part of the body grey, and it is striped with brown, and spotted with white; but underneath it is of a flesh colour. It turns to a bright brown *aurelia* in *July*, and the next *June* becomes a yellowish moth, variegated with green and black.

The lettuce *Caterpillar* is brown and green under the belly, with six feet before, eight in the middle and two behind. Towards the end of *August*, it turns to a brown *aurelia*, with black eyes, and the body variegated with black. A grey *Caterpillar* feeds on the cabbage-lettuce, and on its back there is a dark yellow streak. It turns to a brown *aurelia* in *August*, and to a moth in *September*, with the upper wings brown, and the lower blueish, as well as the body. There is a venomous hairy *Caterpillar* belongs to the same plant, which the birds will not meddle with, and which turns to a large handsome *Butterfly*, spotted with fine red. *Goedard* mentions another that is green, which turns to a grey *Butterfly* with a long trunk.

The white archangel breeds a green *Caterpillar*, streaked with white lines, which turns to a moth, whose upper wings have a dark ground, and part of them shining like burnished copper; the lower are of a dirty white.

The *Caterpillar* of dog's tongue, a weed so called, is streaked with black and yellow, and the wings are marked with different colours. It enters the earth in *May*, where it changes to an *aurelia*, that produces a very fine moth, with the back and upper wings of a bright green, spotted with white and saffron-colour. The upper part of the belly is red, with a black streak, and the lower wings are also red, spotted with black.

The *Caterpillar* of the lavas, an herb so called, is named by *Goedard* the *Centinel*, because it continues in the same posture for some time, and seems to be looking about. In *June* it turns to a brownish-grey *Butterfly*.

The ground-ivy *Caterpillar* is green, and when touched, rolls itself up. It turns to an *aurelia* in *July*, and in *August* to a moth, whose upper wings are of a wood colour, and the lower striped with green. There is another that feeds on this herb, which turns to a fine *Butterfly* in *May*, of a shining golden colour, and on its head there are two fine tufts like feathers.

The *Caterpillar* of the blue *lilac*, is green, and in *May* spins a white *cod*, which turns to a bright *aurelia*, and before the end of the month changes to a bright brown moth. There is another green *Caterpillar* belonging to the same tree, that in *October* turns to a moth striped with green and white.

The *Caterpillar* of the *lemon-tree*, is brown, with a white spot, and they lye in heaps on the leaves of that tree. On the head there is a yellow horn, which is their defence, and in *April* they turn to blackish *Butterflies*, spotted with white and red.

The *flax Caterpillar* is of a greenish brown colour, and under the belly of a bright green, with a black streak on each side. It turns to an *aurelia* in *August*, and in *May* following to a greyish ash coloured moth, with wings variegated with black, and black eyes.

The *Caterpillar* of the orange *flower de luce*, has the upper part of the body brown, streaked with a darker colour, and it is yellow underneath. In *June* it turns to an *aurelia*, and in *August* to a moth, variegated with light and dark brown. There is another *Caterpillar* on the same plant, that turns to a sky blue *Butterfly* with violet wings, and four golden spots on the back.

The *Caterpillar* of the red *flower de luce*, is bred in *Surinam*, and covered with black hairs as hard as iron. The head and feet are red, and the body is full of blue spots, surrounded with a yellow circle. It turns to a fine moth, whose wings before are of a bright brown, and behind of an orange colour, spotted with black.

The *scarmony Caterpillar* is large, and of a bright green colour. It turns to a bright *aurelia*, and in *August* to a small moth, of a greyish ash colour, variegated with dark brown. *Merian* speaks of another of a bright green, that turns to a rose-coloured *aurelia*, and fourteen days after to a small flying insect.

The *Caterpillar* of the *maure*, so called by the *French*, is small and green, with white streaks; it first changes to an *aurelia*, and the day after to a small *Butterfly*. There is another larger, that feeds on the flowers, and in *August* turns to a whitish *Butterfly*. There are *Caterpillars* that feed on the leaves of wild *maure*, that turn to brown *aurelias*, and the next *May* to small moths.

The *feverfew Caterpillar* is brown, and turns to a brown moth.

The *Caterpillar* of the brown *mellilot*, is bred in *Surinam*, and is large, and of a bright green, with brown spots. It has six feet before, eight in the middle, and two behind, and on each ring of the lower part of the body, there is a blood coloured spot. It spins a white web, and turns to an *aurelia*, of a bright violet-colour, from whence in *June* proceeds a moth, with the head, body, horns, and upper wings grey, and variegated with black and white specks and streaks; but the lower wings are of a fine vermilion colour.

The Caterpillar of the water melon is blue before and behind, and green in the middle. The feet are covered with a slime like a snail, and in *August* it turns to an ugly moth.

The Caterpillar of garden mint, is white, streaked with green, and spins a fine web, or cod, which turns to a brown aurelia, and in *August* to a moth, that shines like gold. There is another of a yellow colour, that changes to a moth of a rose colour, which quickly dies. *Albin* mentions a green Caterpillar, that feeds upon mint, that turns to a Moth, marked with the letter Y on the middle of each upper wing.

The Caterpillar that feeds on French mercury, and falls to the ground as dead, when the leaves are stirred. In *August* it turns to a Butterfly that has a sort of a small mantle spread on its wings, which covers all the fore part of this insect, and serves both for an ornament, and for defence.

The night-shade Caterpillar is green, and turns to a light brown Butterfly, that flies very swiftly. *Albin* has two belonging to this herb, one of which is of a yellowish green, spotted with a bright yellow, the other of a dark grey, spotted in the same manner, and with a line of a saffron colour. They both turn to moths, of a reddish brown. From the bodies of these Caterpillars worms proceed, which turn to Ichneumon Flies.

The Caterpillar of the mulberry-tree, has been largely described under the name of the Silk-worm.

The Caterpillar of the musk plant, is green, streaked with black, and turns to a white moth.

The Caterpillar of the myrtle-tree, has a brown head, adorned with four red spots, and a double black whisker, the body is brown, variegated with small red and yellow streaks, and one large black streak along the back, on which there are four tufts of yellow hair, and a black tuft on the hinder ring, which is yellow on the top. The fore and middle legs are yellow, and the pair behind black. It turns to a small moth. *Merian* says he has kept some of them in a box, which changed to vile small flying insects, with a black head and body, and legs of a dark yellow. Others which are caught in *Friesland*, turned to Flies, and others again to small yellow moths. There was likewise another black Caterpillar, with a tuft of yellow hair on each ring, and on each side of them a small white speck. It turned to a white moth, adorned with shining black and brown specks and spots.

The medlar Caterpillar is yellow, streaked with rose colour, and the head brown. Each ring is armed with four black prickles, and the legs are likewise of a rose colour. It turns to a beautiful Butterfly, of a brownish silver colour, across which there are shining blue, green, and purple streaks. On each wing there are three round spots, of an orange yellow colour, bordered with a black circle, and this surrounded with one that is green. The extremity of the wings is of an orange yellow, with black and white streaks.

The Caterpillar of the hazel-nut tree is small and green, and becomes a small Butterfly; but there are other green Caterpillars that turn into Flies. There is one that is not so common, of a green colour, and streaked with white, and a white streak on each wing. It spins a fine white web, and turns to a brown aurelia, and afterwards to a small moth, with the lower wings, feet and horns brown; but the upper

wings are adorned with small white streaks, and the body is of a bright colour, but the eyes are black, and the lower wings shine like gold. *Albin* takes notice of a yellowish green Caterpillar, with a red head, that turns to a moth of a red and brown colour.

The pink Caterpillar feeds on the flowers of that name, and hides itself in the ground in the day time. In *July* it turns to an aurelia, and in *September* to a Fly, before taken notice of.

The Caterpillar of the orange tree has a yellow streak on the body, and each ring has four specks of an orange colour surrounded with very fine hair. It becomes a moth, with a spot on each wing, that resembles talc.

The Caterpillar of bear's ear, produces a green worm, that sucks its body dry. This worm afterwards changes to an aurelia, which becomes an Ichneumon Fly.

The elm Caterpillar spins a small web or cod, and at the end of nine months turns to a Fly. Some call it the Grasshopper Caterpillar, because it leaps from one place to another.

There are several Caterpillars fed on elm-leaves, one of which taken notice of by *Albin*, is of a bright green, inclining to blue, with white lines, and the lower part marked with black specks, but the head is red. It retires into the ground, where it becomes an aurelia, that changes to a bright brown moth. There is another of an olive colour, adorned with red and yellow spots round its wings. It turns to a black and white moth. There is still another, which is very beautiful, inclining to blue, and marked with yellow specks. It turns to a Butterfly, called the great tortoise-shell Butterfly.

Goedard affirms there is a Caterpillar on the leaves of the elm tree, that fixes itself thereon with a thread, in such a manner, that it bends the two extremities of the leaf, closing them together with its web, and leaving an opening before and behind. When it is touched never so slightly, it falls down, holding itself by a thread, and moves about as swift as an eel. There are two sorts, one of which becomes a Butterfly, and the other which is larger, produces worms that have killed the Caterpillar. These are thirty two in number, and lay each an egg, which turns to a small Fly.

The same author takes notice of another, which wraps itself up in a dry leaf, falling to the ground, and covers it with a web, that shines like silver. It turns to a Fly.

Goedard has still another, which produces a Fly that is able to kill Spiders, though all other Flies become their prey, and seems to take pleasure in it. It will break off all the legs, and then drag it along, carrying it off.

There is still another, mentioned by the same author, that feeds on elm leaves, and before it turns to an aurelia, gets into stables and houses among boards. It hangs with its head downwards, and seems to be a round ball when the skin begins to crack. It turns to a beautiful Butterfly. The Caterpillar of the large stinking nettle, is of a black colour, and turns to a yellow aurelia, from whence proceeds a Butterfly, brown without, and within of a dark orange, variegated with a mixture of black and purple. There are others of a bright green, and others brown; but they are all adorned with white and black streaks, and many of them spin a white web. They at length change into

into blue Flies with red heads; though there are some that in *February* are metamorphosed to grey and brown moths, variegated with black and white.

Albin speaks of several *Caterpillars* that feed upon nettles, one of which is black, and has the upper part marked with white specks, and covered with hair. Another sort is also covered with hair, and is of a yellow colour, but spotted. It turns to a *Butterfly*, called by *Ray* the greater blackish *Butterfly*, with wings beautifully adorned with red and white spots. Some call it the *Admiral*. Another *Butterfly* fed by nettles, is called the *Butterfly* like the eye of a peacock's wing, and it is named by *Mouset* the *queen of Butterflies*. The caterpillar it proceeds from, is called by *Ray* the greater black *Caterpillar*, sprinkled with white spots, and beset with black prickles.

There is another produced by the *Caterpillar* of the nettle, termed by *Ray* the lesser *Phalæma*, with oblong wings, variegated with white and blue, and yellowish at the roots. There is yet another, called by *Ray* the greater *Butterfly* with large wings, the upper being brown, and beautifully variegated with white and red spots and lines.

Lijster takes notice of another that never feeds in the day time, for fear it should be devoured by birds, which produces a *Moth*, with saffron coloured wings, adorned with black streaks, and two black spots; as also red spots on the upper wings.

The sorrel *Caterpillar* is hairy, black, and spotted with white and red. It produces a *Moth*, with the body and lower wings yellow; and the head, upper wings, small horns, and feet brown, spotted with black.

The *Caterpillar* of the pelisade, a plant so called, in *Surinam*, is yellow streaked with black, and armed with six prickles. It first changes its skin to one of an orange colour, with a black round spot, but still retains its prickles; some days after it casts its skin again, losing the prickles, and in *June* it becomes a *moth*.

The *Caterpillar* of *palma christi*, a plant so called, is of a greenish colour, covered with long white hair. It turns to a black *Butterfly*, whose upper wings are of the colour of brimstone, and the other of saffron. The same plant breeds another *Caterpillar*, of a black colour, spotted with yellow, that is shut up in a case of dry leaves. It changes to an ugly *moth*, which is very troublesome.

The *Caterpillar* of the palm of the downs, an herb so called in the low countries, has two tails, and when it is angered, it shoots from each a red sting. In *September* it begins to turn to an *aurelia*, and continues in that state till next *June*; and then there come out five small Flies, out of five distinct cells, which when opened, they had no appearance of the skin, or any part of the *aurelia*.

The *Caterpillar* of the palm-tree is red, spotted with brown: they spin a sort of bags on the palm tree leaves, in which they lodge in the night, going out to feed in the day. They turn to yellow *Butterflies*, spotted with brown, and are bred in *Surinam*. There is another little hairy brown *Caterpillar*, bred upon this tree, that turns to a transparent *Butterfly*, spotted with black.

The *Caterpillar* of the papaw-tree, is yellow and green, and becomes a *moth*, that buzzes with its wings. There is another of the colour of raddle, streaked from the head to the tail with red and yellow; and on the head there is a buckler, of a semicircular form, which shines like

a diamond. It turns to a buzzing moth, mottled with iron-grey and white, and the body is streaked on each side with bright red, and on the back with black.

The Caterpillar of the passion flower, turns to a small Butterfly; and there is another that changes to a red and brown insect; besides a third that is metamorphosed to a spotted Flie, furnished with delicate cloven feet.

The dock Caterpillar is of a deep yellow, with dark brown streaks, placed in the form of a cross. In *May* it turns to a brown aurelia, and in *June* to a moth, streaked with white and brown. *Merian* fed a Caterpillar with this plant, that was at first streaked with dark green, which by little and little, turned to a yellow, and then brown. It changed in *May* to a small aurelia, of a bright brown, whose upper part resembled the head of a bird. Fourteen days afterwards it became a small moth, with red eyes, and a red streak on every wing, round which there was a red border.

The poppy Caterpillar is black and yellow, from whence a moth proceeds in *June*. The same plant feeds worms, that afterwards become Flies.

The Caterpillar of the peach tree, has a head and back of a bright brown, and turns to an aurelia, which becomes a moth, and on whose upper wings there are white lines.

The Caterpillar of the poplar tree, has a brown back, and a pale red belly; it becomes a beautiful Moth, of a dark brown, streaked with white. *Goddard* takes notice of another that is white, which turns to a beautiful white Butterfly.

The Caterpillar of the lark's foot, an herb so called, is of a curious colour, variegated with streaks and spots, in *July* it changes to a brown aurelia; and in *May* following to a rose coloured moth, adorned with black and white. The flowers feed a green and white Caterpillar, which turns to a brown moth.

The plantain Caterpillar is of a green colour, but turns to a brown aurelia and in *December* becomes a brown moth. The small plantain feeds a bright green Caterpillar, striped with white the length of the body, and each ring is adorned with a white spot; at the end of *July* it becomes a brown aurelia, and in *August* a moth, with the upper wings white, and the lower grey; but the eyes are black, as well as the horns.

The Caterpillar of the pear tree, has a blackish body furnished with yellowish tufts, and on the fore part of the body there are three claws, in the middle eight feet, of an oaker colour, and behind two more of the same colour. It changes its skin, several times, after which it spins a white web, and turns to a brown aurelia, and fourteen days afterwards it becomes a beautiful bright brown Butterfly, streaked and spotted with divers colours. On the same tree there is a white Caterpillar with a black head, which goes out of its cell in a morning to feed, and then returns back; when it is full grown, it spins a white web, that turns to an aurelia, and then becomes a moth, which lays its eggs and dies. There is another white Caterpillar, when this tree is in blossom, with red spots on the back, and a brown head. In the middle of *July* it turns to an aurelia, and at the end of that month to a white moth, variegated with black. The lower wings are of a bright brown,

brown, and the body of a flesh colour, with little white horns, covered with brown hair, and the eyes are black.

The *Caterpillar* of Indian pepper, is a handsome large insect, with a long red streak on each side, and a white one on the back. The last ring is armed with a rose coloured horn, and on some other rings there is a yellow spot, bordered with rose colour. It turns to an ash-coloured moth, on each side of which there are five gold coloured spots.

The *Caterpillar* of the apple tree is brown, and turns to a brown moth. Another on the same tree changes to a grey moth; and a third which is greenish, is metamorphosed to a moth. Another author affirms there is a fourth, of a brownish colour, with red and blue specks on each ring. It weaves itself a cod, and turns to a brown aurelia, which changes to a white moth, streaked with brown. When it has laid its eggs, it covers them with a yellowish down; which keeps them safe from the cold of the winter.

Merian found upon an apple tree in blossom, a yellow hairy *Caterpillar*, adorned with transverse streaks, and the head was brown; behind the head there were two blue spots, and on each ring spots of a flesh colour. The feet were of the same colour, and it was furnished with small tufts of brown hair. In *July* it spun a yellow web, with meshes like a net; and the aurelia became a white moth, variegated with black; and it had two broad red horns, resembling feathers, and on the hinder part of the head there was a red streak.

The *Caterpillar* of the pompelous, a tree so called in *Surinami*, is white, with a blue head, and the body is covered with long hair as hard as iron-wire. It turns to a beautiful black *Butterfly*, variegated with green, blue, and white, shining like gold and silver.

The *Caterpillar* of the plumb tree, is green, spotted with black, and has a black head. When it is touched, it decends to the ground, by means of a thread drawn from its mouth, by the help of which it gets up again. It is concealed in a leaf, rolled up, and in due time spins itself a cod, which turns to a bright brown moth, with the back part and under sides, of the wings white.

The *Caterpillar* of the damacene plumb, is green, streaked with black, speckled with yellow. It weaves itself an oval cod, that shines like silver, and is as stiff as parchment, which turns to a brown aurelia, which becomes a moth, whose lower wings are streaked with brown and yellow. There is likewise another *Caterpillar* belonging to the plumb tree, which is of a beautiful yellow, and adorned with several tufts in the shape of rods, on the back; and on the tail there is a red spot. When it stretches itself out, four hairy black streaks may be perceived, that run across the body. Some of these turn to grey moths in *September*, and others do not change till the next *April*; but the moths are the same.

The *Caterpillar* of the wild plumb tree, is brown, and adorned with white streaks. It changes to a moth of a dull yellow colour, with white wings and feet, and black eyes. It covers its eggs with down, to preserve them from the snow, rain, and cold. There is another that is black, streaked with yellow, and has a shining body; it turns to a white and yellow *Butterfly*, with wings adorned with black streaks; but the eyes and feet are black.

Albin speaks of one that is of a sea-green colour, which turns to a Butterfly, called the hair-streaked Butterfly. He likewise mentions a black Caterpillar, spotted with brown, the whole length of the back, and streaked with yellow. It turns to a moth, with the back and upper wings brown. There is likewise another beautiful black Caterpillar, with yellow hair, which *Ray* calls the large Caterpillar, with long, thickset, hoary hair, variegated with dun and black, and having whitish lines on the rings. It turns to a large moth, of a whitish and dun colour, with ample oblong wings, beautifully variegated, the lowermost of which are reddish, with black spots.

Albin describes six more, which are,

The bright green Caterpillar, which changes to a moth, with reddish brown wings.

The bright olive colour Caterpillar, that is metamorphosed to a bright yellow moth.

The Caterpillar of the colour of an ozier branch, which turns to a saffron coloured moth.

The hunch-backed Caterpillar, that turns to a white moth, streaked with black.

The green Caterpillar, which becomes a moth, with the upper wings partly yellow, and partly white, and the lower of a chestnut colour.

The dark grey Caterpillar with yellow spots, changes to a moth, whose females have no wings.

Goedard describes one that has four yellow tufts like brushes, on its back, and two horns on the head like a snail; on each side there are two prominences, like oars, one of which is yellow, and the other black; and there is likewise a tuft of hair on the extremity of the body. It changes to a sort of insect, that is neither a worm nor a Butterfly.

Redi speaks of a Caterpillar of an orange colour, so large, that it weighed three quarters of an ounce. He was composed of thirteen rings, between each of which there were several small eminences, of an azure colour. Likewise there were two white spots on each, surrounded with a black line. It spun itself a large cocoon of the colour of moss which looked more like hair-cloth, than any thing else. It became a very large Butterfly, near the latter end of April.

The Caterpillar of the American white grape tree, is very voracious, and becomes a beautiful green and red moth, with streaks of a colour, inclinable to chestnut; but the horns and trunk, are of the colour of gold. There is another belonging to the same tree, that draws itself up when touched, and throws out a froth; it turns to a beautiful moth, spotted with brown, and streaked with white, and the trunk is of a gold colour.

The Caterpillar of the ranunculus, has an orange coloured back, and a pale yellow belly; but the other parts are black, and a little hairy. In May they make a cocoon, which turns to an aurelia, that hangs on a leaf, and fourteen days after it becomes a beautiful moth, with the body, head, and upper wings black, spotted with red. A few days after they lay eggs and die.

The Caterpillar of the meadow ranunculus, turns to a black aurelia, and that to a fine Butterfly, with the upper wings of a bright yellow, speckled with black, and the lower orange, with black streaks.

The

The knot-grass *Caterpillar*, is brown and grey under the belly ; in *July* it turns to a bright brown *aurelia*, and in *August* to a grey moth, streaked with black. There is another that is green, with three yellow streaks along the body, and several black spots ; but what it turns to is not said. There is also a third, that is yellow, streaked with brown, and in *September* turns to a white moth, adorned with red and brown streaks.

The *Caterpillar* of the *rocu*, an *American* tree, is brown, streaked with yellow, and covered with red hair ; it becomes a brownish green moth.

The *Caterpillar* of the *briar*, is of several sorts, which are as follow : the greenish brown *Caterpillar*, which turns to a beautiful *Butterfly*, variegated with green and brown : the green *Caterpillar* with a blue head, changes to a very beautiful moth, variegated with green and brown : the green *Caterpillar* becomes a moth, with the upper wings green and the lower grey : the hairy *Caterpillar* is brown and red, and changes to a moth, called by the *English* peasants the *devil's Gold ring* : the green and yellow *Caterpillar*, is metamorphosed to a moth, variegated with white and black : the ash coloured *Caterpillar* turns to a straw coloured moth.

The *Caterpillar* of the *rocket*, was put into a glass vessel, and was observed every night to change its colours successively, it being first of the colour of gold, then blue, afterwards black, and last of all purple ; they were all undulated when the insect crept along. It had two teeth made like sickles, and the rings of its body were supported on each side with crooked feet. Each ring was covered with hair, which was long in the last, and in the form of prickles. It turned to an *aurelia*, of the size of a walnut, of a greenish colour, and pointed at the ends, in which state it continued a month, and then became a *Butterfly* of the largest and most beautiful kind : the extremities of the wings were turned upwards like a hook, and the edges were fringed, and of various colours ; likewise the wings were spotted with black, red, and blue, which looked like eyes, as fine as those in a *peacock's tail*.

The *Caterpillar* of the *rose bush*, is of different kinds, some of which turn to moths, others to *Flies* : those that are half green, and half rose coloured, become little brown *Butterflies* : the bright green *Caterpillar* with white streaks along the body, has each ring marked with a white streak above, and a yellow streak beneath ; but what it turns to, is not said ; but there is another, which had six feet before, eight in the middle, and two behind, that turns to a brown *aurelia*, and in *July* to a bright brown moth, whose lower wings shone like gold.

Albin observes, that of the *Caterpillars* of the *wild rose tree*, some are brown, and others green, with a red head ; they turn to moths of a brownish black colour. On a branch of the *dog rose*, there was a flesh coloured *Caterpillar*, with a hump back, that turned to a flesh coloured moth : there was also another that was green, with a white line on the back, that turned to a *fle*, called the *black headed Bee Flie*.

Merian took notice of a green *Caterpillar* that fed on the *rose bush*, with a black head. When it was touched, it let itself down by a thread, and got up again by the same. In *May* it turned to an *aurelia*, and fourteen days after to a small *Butterfly*, that shone like gold.

The *Caterpillar* that feeds upon *tue*, is green, and variegated with red, yellow, and blue spots ; and it changes to a yellow *Butterfly*, streaked and enamelled with black, as well on the body as wings. On

the extremity of the lower wings there are two round red spots, and others that are blue, terminated by a hairy violet line. At the extremity of the edge there are two small appendages, which look like tails to the wings, and on the head there are two horns or feelers, which are long, blackish, moveable, and thicker at the extremity, than at the root. It dies in four days time.

The Caterpillar of the willow, is large, and turns to a grey moth: the black water willow, feeds a Butterfly with small specks, which turns to a grey moth, that lays green eggs. Another willow Caterpillar turns to a grey and red Butterfly, and a third is armed with horns, and changes in *July* to an aurelia, which becomes a moth in the *April* following. A fourth is metamorphosed to a flying insect, and a fifth, which is half yellow, and half green, becomes a yellow Flie.

Merian mentions a very beautiful green Caterpillar, speckled with white, and a white streak running across each ring. It turns to an aurelia, and the next *May* to a moth, with head, body, and upper wings brown and white, variegated with yellow and black; but on the lower wings there are two large black eyes in the middle, surrounded with a blue circle: the upper part is of a bright brown, and the lower of a rose colour. It has small black eyes, and little horns.

He takes notice of another that is small, and of a bright green, adorned with white streaks, which turns to a brown aurelia, and fourteen days after to a small moth, of a greyish ash colour, adorned with white streaks.

The Caterpillar of the red willow, is green, and turns to a dark brown aurelia, which in *August* changes to a bright brown moth, with wings streaked with brown: the same tree breeds another of a small sort, that turns to an aurelia, and then to a Flie, whose body, head, and horns are black, with two wings transparent, and six yellow feet.

Albin speaks of several sorts of Caterpillars found upon the different kinds of willows, which are as follow: the green and yellow Caterpillar, called by *Ray* the most beautiful double tailed Caterpillar, and which turns to a moth, that the same author terms the great and most beautiful moth, with large external ash coloured wings, elegantly variegated with black spots and lines: the beautiful green Caterpillar, whose moth *Ray* names the middle sized domestic moth, because in *July*, *August*, and *September*, it comes into houses: the olive coloured Caterpillar, which turns to a yellow Butterfly, with wings variegated with black: the flesh coloured Caterpillar, that becomes a bright yellow moth, with shades and spots of a darker colour: the green and red Caterpillar, from whose two extremities a Flie proceeds: the yellow Caterpillar that turns to a Beetle: the dark brown Caterpillar that changes to a moth, with the upper wings yellow, and the lower of a yellowish white: the ruddy Caterpillar that turns to a moth, called by some the moth with red lower wings: the purple Caterpillar with red and yellow spots, changes to a white moth, streaked with black: the green Caterpillar with small red lines on the back, becomes a white moth, streaked with black.

Goedard takes notice of a Caterpillar of a bright yellow colour, variegated with a little black, which bears something on its head like an escutcheon gules, with a chevron of gold. It turns to an aurelia in *August*, and in the same month of the following year, it becomes a strong vigorous Butterfly, and yet it lives but two days.

The Caterpillar of thyme, has the back marked with longitudinal streaks of different colours, that is, blue, purple, yellow, red, and black; besides which there are many small specks. It turns to aurelia, like a silk-worm, from whence four Flies proceed, which are probably the eggs of the Ichneumon Flie; they are larger than common Flies, with blueish heads and wings; but every where else of a purple colour.

The nighthade Caterpillar turns to a red aurelia at first, which by degrees becomes black, and is transformed to a large Butterfly, which makes a noise with its wings like a Bat. It is of a yellow colour, variegated with black on the wings, back, and belly. On the head, which is black, there are two tufts, of a little lighter colour; but the eyes are of a chestnut colour, and the trunk black and curled: the six feet are hairy and yellow, and each of them terminate in a hook. What this changes to, Redi gives no account.

The marygold Caterpillar is of a dark colour, with black lines, and the belly of a bright green, with a white line that parts the dark colour from the green, it retires into the ground, where it turns to an aurelia, and then changes to a dusky moth, marked with a white spot on each upper wing: there is another breeds upon this plant, with a black back, and the head and the belly of a dirty green, with red spots like eyes: the moth that proceeds from it has two round spots upon each upper wing, surrounded with a white circle, and there is a white streak on their extremity.

The Caterpillar of the elder tree, is of a bright yellow, with two black streaks that run across the back, and three others that run long-ways behind. It has black teeth, and changes to a bright brown aurelia, which becomes a white moth, streaked with brown: there is also a green Caterpillar belonging to this tree, which becomes a bright brown moth.

The Caterpillar of the sycamore tree, is yellow, and covered with saffron coloured hair. When disturbed, it draws itself up like a hedgehog; it changes to a grey moth.

The Caterpillar of the tabruba, a Surinam tree, is yellow and black, and covered with hair, like a brush; it becomes a sort of Bee, streaked transversely with yellow and black.

The Caterpillar of the lime tree, is a very large and beautiful insect, of the colour of silk, spotted on the back with white; but the lower part of the body is of a deep yellow. On the hinder ring there is a blue horn, and behind that a yellow spot. It turns to a black aurelia, and seems to be dead till May in the following year, and then changes to a pale yellow moth, spotted with black.

The Caterpillar of turnsole, hides itself in the ground all day, and in the evening comes out to feed. It turns to an aurelia in May, and in June the year following, becomes a Butterfly, with the letter O on its wings.

The trefoil Caterpillar is red and yellow, and turns to a whitish Moth.

The Caterpillar of the aspen tree, is of a golden yellow colour, and changes to an ash coloured Moth, with the extremity of the upper wings of a copper colour.

The Caterpillar of the purple tulip, though mentioned by Merian, is not described; but it turns to a Moth, whose upper wings are reddish, and the lower, with the rest of the body grey.

The valerian *Caterpillar* is of several kinds, some of which become grey Moths, and others brown Butterflies.

The *Caterpillar* of the vine, is of two kinds, the one being brown, and the other green; they are both streaked and spotted with black and white. That that is brown, changes in *July* to a bright brown *aurelia*, and continues in this state till the next *May*, when it becomes a beautiful Moth, with the head, body, and upper wings of a rose colour, variegated with green streaks and spots. The lower wings have each a black spot, and the eyes are of a yellowish green. It has a long slender trunk, of a yellow colour, and curled at the end. It is one of the most beautiful and remarkable of this kind.

Albin mentions an olive coloured *Caterpillar* that feeds upon the leaves of the vine, and becomes a grey mottled moth, with two white spots on the upper wings.

The *Caterpillar* of the vine of Surinam, is brown, spotted with white, and there is a black spot on the last ring, in the middle of which there is a white skin, that shines like crystal, and which rises and falls when this insect breathes. It becomes a beautiful green moth, with the ends of the wings painted with red and blue.

Goedard takes notice of one that feeds on the vine, which he calls the Elephant *Caterpillar*, it having a trunk like that animal, but what it turns to is not known.

The violet *Caterpillar* is of a dark brown, with a white streak on each side the body, and the head and fore feet are yellow. It turns to an *aurelia* in *August*, and the next *April* to a moth, with the head, body, and wings variegated with a bright yellow; as also with black spots: the eyes are black, and the horns and legs are of the same colour. There is another of a pale green, spotted with yellow, which in *June* turns to a greenish *aurelia*, and soon after to a white moth, variegated with grey spots; likewise the horns and feet are grey.

The *Caterpillar* of the holm oak, is covered with exceeding long hair, partly black, and partly of the colour of rusty iron, and there are fourteen prickles on the rump, placed in the same form as the petala of the flower of a red daisy. It turns to a reddish *aurelia*, which afterwards becomes black; and then turns to an insect like the Flie of the Silkworm, of a bluish chesnut colour, spotted with black. It has two large black tufts on its head, and a small one of black silk at the extremity of the belly.

The *Caterpillar* of the zursach, a Surinam plant, is large and green, and turns to a large Moth, whose body is adorned with six round orange colour spots. It has four wings, and six feet; and is black, but curiously spotted. Its trunk consists of two pipes, which are used to suck the honey out of flowers; and after it has done, it rolls it up in such a manner, that it can hardly be seen. It is not easily killed, and it lays a vast number of white eggs. This plant also feeds a green *Caterpillar*, which becomes a white and black Moth, with a double trunk, like that of the former.

The *Caterpillar* of an anonymous plant, is green, spotted with white, black, and red, and becomes an ash colour moth, spotted with black. *Merian* says this plant grew in his garden, and yet he could not meet with any one that knew its name.

The feathered *Caterpillar*, is so called, from having a small brown feather on its rump, and it turns to a white vigorous *Butterfly*: there are several other *Butterflies* on different kinds of trees and plants, which are taken notice of by travellers, but in so vague a manner, that little or nothing certain can be said about them.

The sea *Caterpillar* with coloured shining hairs on the sides like a rainbow, is by some called the sea *Porcupine*, by others the sea *Mouse*, and by others again the golden *Worm*. It is an uncommon insect, and is chiefly to be met with in the *Western ocean*. *Linnæus* informs us, that the mouth is furnished with threads like the hairs of animals, and have the shape of feelers; the body is in the form of an egg, covered with purple shining points or prickles, and glossy hair of the same length, of a greenish yellow colour; at the center there is a small opening, and under the skin of the back there are folded membranes, which resemble the gills of crabs. It has forty feet on each side, like so many parallel cones, connected to the edges of the body, terminating in points, and as crooked as a sickle; but on the inside there is a sort of soft hair: This insect, properly speaking, is not of the *Caterpillar* kind; at least we are ignorant of any transformation it undergoes.

The dirty brownish yellow *Caterpillar*, is composed of nine or ten joints or rings, besides the head and tail; the head is roundish, and terminates in a snout or mouth, consisting of two sharp points. It is adorned with four rows of knobs, which rise like the heads of small brass nails, and are of a yellow metalline colour; but they are so bright and glittering, that it is impossible to imitate them by art, for they as much excel polished gold, as that metal does brass. It was communicated to Mr *Edwards* by doctor *Mead*, and was doubtless brought from some distant country.

Frysch has, 1. The thin haired *Caterpillar*, variegated with divers colours, that lays its eggs about the bud of trees, in a spiral line, and fixes them thereto with a gummy substance.

2. The *Caterpillar* with blue and reddish bristles upon the back.

3. The willow *Caterpillar* with thin hair, and yellow spots upon the back.

4. The chesnut *Caterpillar* with yellow shaggy hair, and yellow spots upon the back.

5. The asparagus *Caterpillar*, that is of the small kind, and has a smooth body, which afterwards changes into a *Beetle*.

6. The camel *Caterpillar*, so called, on account of a bunch on its back.

7. The variegated *Caterpillar*, whose young are wrapped up in leaves, which hang to the boughs of trees in the winter time.

8. The white *Caterpillar* variegated with black and white spots, and is of that kind which has but few feet.

9. The green *Caterpillar*, with few feet, spotted with black.

10. The small ash coloured willow *Caterpillar*.

11. The small ash coloured *Caterpillar* of apple trees.

12. The *Caterpillar* that feeds on the flowers of woodbind or honey-suckle.

13. The dusky and hairy *Caterpillar* is to be found on nettles; and sinking gladden.

14. The brown, large, smooth *Caterpillar*, is to be met with on fruit trees.
15. The green *Caterpillar* of the smaller species, that feeds upon cabbage-leaves.
16. The great green many footed *Caterpillar*, with seventy rings, that feeds upon willows and alder trees.
17. The *Caterpillar* with yellow and whitish lines, that hang at the ends of branches of trees in winter time.
18. The willow *Caterpillar* with two white spots on its back.
19. The green *Caterpillar* marked with the character of the conjunctions of the planets.
20. The green *Caterpillar* with only two feet on the belly, and three white lines on each side.
21. The green *Caterpillar* with four feet on the belly, and six white lines on the back.

The *Huntress*, a name given by *Goedard* to a *Caterpillar* which is found upon the downs of *Holland*, and which lives upon all kinds of grass and herbs, without seeming to like one more than the other. The author had one which became a *Chrysalis* on the twelfth of *July*, and a *Butterfly* on the fifth of *September* following.

There are a sort of hairy *Caterpillars*, which in *England* have the name of *Palmer Worm*, because they wander from place to place, like *palmers* or *pilgrims*; some call them *bear Worms*, because they are all over hair, and others *Millers*, but for what reason is uncertain. Many of these feed on all sorts of greens indifferently, though some of them do not.

The *Palm-Tree Worm* is a native of the *West-Indian* islands, and is bred in the heart of a sort of palm tree, after it is cut down: they are as thick as a man's finger, and about two inches long; they appear to be nothing but a bit of capon's fat, covered with a fine transparent skin. There seems to be no entrails nor guts when viewed with the naked eye; but with a microscope they may be discovered: the head is black, and fixed to the body without any neck: they are eaten by the *French*, after they have been roasted before the fire, when a small wooden spit has been thrust through them. When they begin to be hot, they powder them with a crust of rasped bread, mixed with salt, and a little pepper and nutmeg: this powder keeps in the fat, or at least sucks it up; and when they are done enough, they are served up with orange-juice: they are highly esteemed by the *French*, as excellent eating. When they have been sometime laid in the sun, they yield a sort of oil, which is excellent for cold pains, and especially for the piles.

The blackish-bodied *Palmer Worm* with white spots on the sides, has the hair on the under part of the body of a sort of saffron colour, but that upon the upper parts is grey, three rows excepted, on the neck near the head, which are of the same colour with those on the belly: this first changes to an *aurelia*, and then to a *Butterfly*, which has been before described.

The black *Palmer Worm*, has a yellow coloured belly, and spots of the same colour on the sides. It turns to a dusky *aurelia*.

The brownish yellow coloured *Palmer Worm*, is all over of those colours, except the stripes on the sides, that run obliquely from every joint, and the head is of a crimson colour.

The dusky *Palmer Worm*, is of a brownish black colour on the belly; but the back and upper parts are of a dusky yellow, and it has a forked line on the face, of the colour of whey.

The reddish bay *Palmer Worm*, has the sides of the belly of a greyish colour, and the body is variegated with yellow spots, which are of a deep black colour above: there are hairs like rays proceed from them, of a yellowish colour, which are harsh, and grow to a point from the middle. It does a great deal of mischief among grafts and corn.

The grey *Palmer Worm* is all over of that colour, except in the incisures, some of which are black, and others white, and there are spots of the same colours here and there: the bristles both above and below, are placed like the teeth of a saw, and are very rough and strong, but of the same colour with the body.

The black *Palmer Worm* with yellowish hairs, has a sort of pencil on each side the forehead, and another upon the rump, as black as a crow; there is also hair like wedges on the back, with white roots; but the other parts are blackish.

The murrey coloured *Palmer Worm*, has as it were, seven tufts of hair, in the shape of wedges, on the back.

The variegated *Palmer Worm*, have all the incisures of different colours, and yet there is not one entirely of the same colour, but there is a sort of a silver stud upon each.

The *Palmer Worm*, variegated with black, blue, green, and yellow lines, running longways, seems to have golden spots between them: the hair is very soft, and is of a very pleasant green; but when it becomes an aurelia it has a purple case.

The green *Palmer Worm*, is of the colour of a green leek; only the incisures are whitish, and the hair in the middle of a brighter green.

The hasle *Palmer Worm*, is all over of a dusky green, except a few black spots, and the horn that grows out of the rump, which is of an agreeable rose colour. It is chiefly met with on the leaves of hasle trees: there are two kinds of them, one of which is of a deep, and the other of a pale green.

The negro-faced *Palmer Worm*, seems to have an embroidered coat, very artificially worked. On the forehead there are two hairy horns, instead of feelers, and perhaps serve for the same purpose; and there are the like upon the rump or tail: the skin is of all the colours of the rainbow, and is variegated with roundish spots, of a purple colour, which seem like so many studs, running along each side: the hair shines greatly, and strikes the eyes pretty strongly on a sun-shiny day.

The blue faced *Palmer Worm*, is variegated with white, red, and blueish spots, turrows, and the hair is of a shining gold colour.

The black-headed hedge-hog *Palmer Worm*, has a very black head, and a body variegated with dark blue spots, but the hair is of a shining saffron colour.

The pear tree *Palmer Worm*, has a head as black as ink, and a body furrowed with black, red, and milk-white colours. From the shoulders almost to the end of the back, there are livid tubercles speckled with white: the egg from which this proceeds, is of a reddish bay, as is also the aurelia, and the colour of the hair. It feeds upon the buds of pear trees: there is another of this kind, with only one tubercle or hump upon the back.

The dusky yellow *Palmer Worm*, is of that colour, from the head to half way on the back, and then becomes of a white lily colour. On the belly there are a sort of studs, of a yellowish ash colour.

The nettle *Palmer Worm*, has feet of a dull yellow colour, but all the rest of the body is black; the hairs are erect, and terminate in a sort of points, which will wound the fingers when touched, causing an itching at first, and afterwards an intolerable pain. From its stinging in this manner, it has its name.

The cabbage *Palmer Worm*, has a blueish head, and two raised yellow lines on each side the body, between which there is a grey space, speckled with black: the hair is of an ash colour, and so is the aurelia.

The hedge *Palmer Worm*, has a head of a saffron colour, only on the snout there is a whitish triangle: the body is variegated with red, white, yellow, and black stripes, or spots, placed in no regular order, but the hair is of a yellowish colour. It lives among hedges, and strips them of their leaves.

The lesser hedge *Palmer Worm*, has a blueish face, and all the rest of the body is blue: the hair is of the same colour as the former.

The crane's hill *Palmer Worm*, is of a pretty large kind, and is adorned with black belts, spotted with white; so that at first sight they appear to be of an iron grey: the belly and feet are white, and the spaces between the belts or girdles, are of the colour of green leeks. It feeds upon weeds, and more particularly the herb called crane's bill: the *Palmer Worm*, with a variegated body, is from the head to the third incisure, of a whitish colour, like chalk, but the five next following, are of an iron grey, and the three last of the colour of ceruss: the feelers consist only of hairs, at the end of the tail there seem to be two more. Besides these, there are four upright tufts on the back, consisting of hairs, placed in a dentated order.

The ragwort *Palmer Worm*, has a head and legs of a dull purple colour, and the belly of a palish green; but the body is of an unpleasant green, variegated with black, yellow, and flame coloured spots: the colour of the hair is the same as that of the belly.

The hedge-hog *Palmer Worm* has a body chequered and variegated with black and yellow, and it has spines or thorns that are yellowish. In the beginning of the autumn, they change into an ash coloured aurelia.

The variegated hedge-hog *Palmer Worm*, has the fore part of the body, as far as the middle of the back, of a yellowish black colour, but the hinder part is of a whitish yellow, and it has hard thick spines or thorns, of a blueish colour.

The bramble *Palmer Worm*, is of a blackish ash colour, and on each side there are three palish yellow furrows; it is but thin of hair, which is black.

The horned *Palmer Worm*, is variegated with green and yellow, but the hair on the middle of the back is grey, and the horn is notched.

There are other *Palmer Worms*, that feed upon vervain, hops, liquorice, night-shade, the elder tree, the elm tree, figwort, basil, and dill, but as they contain nothing very particular, we shall pass them over; however we shall take notice of one, called the flinking *Palmer Worm*, mentioned by *Gesner*. It is like the horned *Palmer Worm*, and has so strong a smell, that any one would take it to be venomous. When it is angered

angered it holds up its head, and the two fore feet, and seems to be blind. It is about as long and as thick as a man's finger, and has a few hairs scattered over the back and sides: the back is black, and the belly and sides of a roundish yellow colour: the body consists of fourteen joints, and there is a furrow on each, that runs along the whole length of the body; it has a black hardish head, and a forked serrated mouth, with which it lays hold of any thing, as with nippers. It has sixteen feet, in the same manner as most Caterpillars, and is doubtless of a poisonous nature.

The *Sphondyle*, called in the North of *England* an *Andever*, and in the south a *Wurl Worm*, is as long and as thick as a man's little finger, has a red head, but the rest of the body is white, unless on the upper part, where it is blackish. It does a great deal of mischief in gardens and orchards, for it gnaws the bark off the fruit trees; it will also eat the roots of the wild cucumber, the wild vine, birthwort, centory, and other plants, which no other insect will touch. The next year after hatched it turns into a *May Beetle*, which feeds upon the roots of trees, even of the poisonous sorts, and causes them to wither away; which when the gardeners perceive, they dig about them, and take them out to kill them. They do most mischief in *April* and *May*.

These Worms are of different sorts, for some are in the shape of a cross, of a whitish ash colour, and a blackish head; but when they are touched, they fold themselves up like a ball, or rather like a wheel that women make use of in spinning. Another of this sort is of a red colour, and was found two feet deep in the ground; it had a very black head, a forked mouth, a yellowish red neck, a scarlet back, and the six fore feet of a reddish colour; but the belly, and the rest of the body, were quite yellow, only on each side there were eight reddish specks. It is as long as a man's middle finger, and in the summer it changes to a *Flie*.

Another of this kind has a shining thick body, which from the middle of the back to the tail, is of a blueish colour, but the fore part is greyish, and it has a yellow head and feet, with a reddish forked mouth. It stirs its body in an odd manner, like the motion of waves, without changing its place, and then it seems to alter its colour. While it remains in the earth it is all over whitish, but when it is angered, it appears to be livid. This is much in the same shape as the former, only it rolls itself up. From this worm, a very large *Flie* proceeds, with four wings.

There is another insect of this kind, found at the roots of onions, and is much of the same shape as the former, with a green head, fourteen feet, and a horned whitish green tail. The body is variegated with green, yellow, and murrey colour. It is called by some the *Onion Worm*.

C H A P. XII.

OF INSECTS OF THE SPIDER KIND.

THE most common *Spiders* in these parts of the world, are the house Spider, which weaves its web in neglected rooms. The garden Spider, that weaves a little round web, in the center of which he keeps in the day time: the black Spider, that inhabits the holes of old walls: the wandering Spider, that has no abode, like the rest; and the field Spider; besides many others that we shall take notice of as we go along. All these Spiders have somewhat in common among themselves; and they have also a characteristic which distinguishes them from each other. Every Spider consists of two parts, the head and the breast, which is separated from the hinder part, or the belly, by a slender string: the fore part is covered with a hard shell, as well as the fore paws or legs, that adhere to the breast: the hinder part is cloathed with a supple skin, beset all over with hair: they have several eyes on different parts of the head, generally eight in number, and sometimes only six, two before, two behind, and the rest on the sides of the head: they have all eye-lids, and are covered with a hard polished crust. As their eyes are immovable, they are furnished with such a number of eyes, that they may see what is doing all round about them.

They have two prickles on the fore part of the head, or rather two branches, rough, with strong points, or dentated like two faws, and terminating in a claw, like that of a cat. A little below the point of the claw, there is a small hole, through which it seems to emit a very active poison: this is the most dreadful weapon they have against their enemies; and they can cover, or stretch them out, as they have occasion. When they do not make use of these claws, they lay them down on the branches like a sickle on its handle: they have all eight legs, articulated like those of Lobsters, and at the end there are three crooked moveable claws, namely, a small one on the side, placed like a cock's spur, by the assistance of which they adhere to the threads of their webs; and there are two others larger, the inside of whose hook is dentated, and serves to fix them on any thing they please, or to walk up the side of a wall, and even with their backs downward: the most polished bodies, such as looking glasses and marble, have such inequalities, that they can lay hold of them with their claws. But they do not always make use of these, there being near the claws two tubercles, or a sort of sponges, on which they can walk in a softer manner, reserving the former for other purposes, wherein sharp claws are required.

Spiders, besides the eight legs already mentioned, have two before, which may be called arms, because they are of no service in walking, but are used in holding and managing their prey: though they are thus armed, they could not go to war with success, if they were not as well furnished with toils to catch their game, especially as they have no wings to fly after it. For this reason Spiders have the art of spinning threads, with which they weave their webs, which are a sort of nets, spread out on purpose to take their prey; and they lay them in those places where the Flies are most likely to pass and repass almost continually: the Spider

Spider lies in ambush behind the net, and patiently waits for its enemy, who is not aware of it.

Spiders have five tubercles or nipples, at the extremity of the belly, whose aperture they can open and shut, enlarge, or contract, just as they please. It is through these apertures that they spin the gluey substance with which their bellies are full. In proportion as the spider lets this glue pass through one of the apertures, the head grows longer, as she recedes from the place to which she had fixed the end. When she contracts the apertures of the nipples, the spinning ceases, and she remains hanging thereto. She afterwards makes use of the thread to re-ascend by the help of her claws, much in the same manner, as some men will swarm up a rope. However this is not all the use which she makes of this thread.

When a house *Spider* is to begin her web, she first chuses a place where there is a cavity, such as the corner of a room, that she may have a clear passage to pass freely on each side, and to make her escape if there be occasion. She throws upon the wall a small drop of this glue or gum, and lets some more pass through a small aperture, and the thread lengthens as she draws back, and till she has got to the other side, where she would fix her web; than she lets another drop fall, by which she fixes it to the place; thus she passes and repasses, till she has made it as large and as strong, as was first designed: those that have seen them at work, affirm, she makes more threads than one at the same time, that she may finish her net the sooner. However it is observable, that the first row of threads, which may be called the warp, lye all parallel to each other; after which she crosses them with another set, which may be named the woof, and by a particular art that she has, she fastens them to each other, which perhaps is entirely owing to the gluey substance she makes use of.

A *Spider* seems to know very well, that if she appeared openly, or in sight, she would miss of her prey; and therefore she weaves a small cell for herself, where she lies hid, and keeps upon the watch: there are two passages, out of it, the one above, and the other below, that she may walk out which way she pleases, to visit her work, and keep every thing clean; for she takes away from time to time, the dust that is got upon it, or rather shakes it off, by giving it a stroke with her paw, which if she did not do, it would soon be over-loaded and consequently the fabrick would be destroyed.

There are generally a sort of threads, that proceed like rays from the center, where she is hid, and where she stands sentinel; so that she can readily perceive when any part of the threads are touched, when the game is at hand, upon which she immediately falls upon it. Another advantage she receives from the mechanism of her cell, is to have a retreat, where she may devour her prey in safety, and conceal their carcases, that they may no prevent others from falling into the same snare.

The magazine of the gum or glue, does not always last, for when the spider grows old, it is entirely exhausted; and then to get her living, she goes to the web of a young one, who either out of kindness, or fear, gives place, and weaves herself another.

The labour of the garden *Spider* is quite different from the former, and yet is not performed with less art. Many people believe that she flies

from one tree to another, but this is a mistake, for when she fixes one end of a thread to a branch, or any other substance, then with her two hind paws she draws out one or more threads from the nipples, three or four yards in length, which she lets float in the air: these threads being driven by the wind on one side or other, to some neighbouring body, as for instance, a house, a rail, or a tree, or a stake on the other side of a river; this thread fixes itself thereto, by its natural clamminess; then she draws it a little, to see whether it is fast or not, and then this becomes a bridge, on which the Spider can pass or repass at pleasure: this done, she doubles or triples the thread, according to her own fancy; and then advancing towards the middle thereof, she there fixes another, and lets herself down with it, till she meets with a stone or plant, or any other solid substance, on which she may rest. She re-ascends on the second thread to the first, and then begins a third, which she fixes in the same manner. When she has thus fixed three threads, she strengthens them, by making them double; then she endeavours to find out a square place, which is not very hard to do, and which is owing to the artificial management of the threads. However it is remarkable, that she never leaves off spinning, while she passes backward and forward; then she goes to the right and left, and by this means forms a square, or a figure approaching thereto; then she weaves a cross in the same manner, whose point in the middle, becoming the center, from which she lays all the rest of her threads, like so many spokes of a wheel. She places herself at the center, where all these threads cross each, and then she forms a small circle round about it, and then another, and so on, proceeding always in a circular manner, till at length she comes to the large threads, which support the whole work.

The net being thus spread, she places herself at the center of all these circles, with her head downwards, because her belly, which is fixed to a very slender neck, would fatigue her too much in any posture; whereas in this, her paws and breast support the belly. There she waits for her prey, but seldom very long; for the air being full of Flies and Gnats, that pass backwards and forewards, some of them soon fall into the net. When the Flie that is taken is small, it is dispatched upon the spot, but when it is large, and makes some resistance, the Spider wraps it up with her web, binding it so fast, that it is not able to stir either legs or wings, and then she carries it to her nest, which is underneath the web, and she hides it under leaves, or a tile, or some other commodious shelter, to keep it from the rain.

As for the black *Spiaer* that lodges in cavities, she only weaves a sort of a web about the mouth, leaving a round hole in the middle, as a door to go in and out at. When an insect passes near the place, it never fails to move one of the threads which run out on all sides, like so many rays; which the Spider having notice of where she lies in wait, immediately runs to catch it. This Spider is more mischievous than the rest; for if she is taken up with two sticks, or otherwise, she will be sure to bite the instrument that holds her. She is also much harder than the rest, so that a Wasp for instance, which by its sting, and by the hardness of its body, puts the other sort to a great deal of trouble, can make no impression upon this; for the black Spider cannot be penetrated.

metracted with its sting ; but on the contrary, she can break the bones and the scales of the Wasp, with her nippers.

The wandering *Spiders* are of several sorts and colours. They generally run and leap ; but as they have not thread enough to wrap up their prey upon occasion, much less to stop the motions of the wings and legs of the Flie, nature has furnished them with two fore paws or arms, with two tufts of a sort of down, with which they can restrain the motion and agitation of the wings of their enemy. There is another black sort, less than this, which weaves her web in *September* and *October*, among the grafts in the meadows, or in stubble, which remains after the harvest ; however she lets some of the threads be carried in the air by the wind, insomuch that it is often full of them. These threads unite, lengthen, and stop, at any place they are driven to, and the Spiders make use of them in such a manner, that one would think they could fly, or they are carried along with them by the wind. There is nothing more remarkable in these, than the extreme length and firmness of their legs ; for as they are designed to live among slender grafts, and weeds, the smallest blade would stop and embarrass them, if they had not these long legs, to raise them higher than the common grafts, and to run speedily after its prey.

With regard to their laying of their eggs, they have more care and foresight than is generally thought ; for they are so far from leaving them to chance, that they weave a very strong web wherein to lodge them. Of this they make a strong bag, wherein they lay their eggs, and it is hardly credible what pains and trouble they are at, in performing this work. This bag is often seen joined to the hinder part of their bodies, in such a manner, that many take it to be a part thereof ; if by any accident it happens to be struck off, the Spider never fails to join it thereto again by their natural glue. When the eggs are hatched, they get upon the old one's back in such a manner, that without a nice examination, you would take them to be part of their body, though perhaps there are a thousand in number.

Another sort of *Spiae* lays her eggs in a bag, made like a cap, which is sometimes fixed to a wall, and sometimes to a leaf, where she sits upon them night and day, and she would sooner suffer herself to be killed, than abandon them till they are hatched.

There is yet another sort, that make two small bags, of a reddish colour, which they hang up with threads, and before them they place a tuft of leaves to hide them from birds and Wasps, which would otherwise fall upon the bags, which are full of eggs ; for the wind keeping them continually in motion, it prevents them from taking notice of what hangs behind. It is wonderful to consider the strength which all Spiders in general endow their bags with ; and they generally hang them up against a wall.

The *Tarantula* has some resemblance to a house Spider, but it is the largest yet known in *Europe*, and is a native of that part of *Italy*, called *Apuglia*. Its body is three quarters of an inch long, and of the thickness of one's little finger ; the colour is generally of an olive brown, variegated with one that is more dusky. It has eight legs, with three joints each, and eight eyes ; from the mouth proceeds a pair of nippers, dentated or ferrated on the inside, which are solid, and so very sharp,

sharp, that they can easily pierce the skin therewith. Between these and the fore legs, there are two little horns or feelers, which it is observed to move very briskly, when it approaches its prey. It is covered all over the body with a sort of short soft down, and propagates its species like other Spiders, by laying of eggs, which sometimes amount to an hundred or more. In the summer months, particularly in the dog-days, the Tarantula creeping among the corn in the fields, bites the mowers, and passengers; but in winter it lurks in holes, and is very seldom seen: the part which is bitten, is soon after discoloured with a livid black or yellowish circle, attended with an inflammation. At first the pain is scarcely felt, but a few hours after there comes on a violent sickness, difficulty of breathing, fainting, and sometimes trembling; the person who is bit, after this does nothing, but laugh, dance, and skip about, putting himself into the most extravagant postures; but this is not always the case, for he is sometimes seized with a dreadful melancholy. At the return of the season in which he was bit, his madness begins again, and the patient always talks of the same thing; sometimes he fancies himself a shepherd, a king, or any other character that comes into his head, and he always talks in a very extravagant manner: these troublesome symptoms sometimes return for several years successively, and at length terminate in death. Gentlemen who have travelled into *Italy*, affirm, that this odd distemper is cured by a remedy altogether as odd, which is music; for this only will give them ease, and they make use of the violin in particular: the musician plays several tunes, till at length he happens to find one that makes a great impression upon the patient, at which time he begins to dance, and continues so doing, till he is all over in a sweat, which forces out the venom that did the mischief: this dancing sometimes continues for three or four hours before the patient is weary, and before the sweating is copious enough to cure the disorder.

The Spiders of the *West-Indies*, have much the same properties as those of *Europe*, for they have almost all a sort of bags, which seem to be made of fine leather, though it is woven with their threads; in these they lay their eggs, and either sit on them to hatch them, or to preserve them from being devoured by other insects. However in the woods there are some that are not common, for they are an inch and a half long, and an inch broad; the fore part is made like a cushion divided into small squares, and the belly or hinder part is of an oval shape, variegated with spots and lines: they are all grey, and have very long legs, which are hard and hairy like the paws of a flying stag.

The Martinico Spider is divided into two parts, and the belly, or hinder part is almost as large as a hen's egg, and covered all over with pretty long hair: the fore part is the shortest, and not quite so thick, and in the middle of the back there is a small round opening, which will hold a pea, surrounded with hair, a little longer than that on the other parts of the body. From each side of this part there proceeds five legs, longer than a man's finger, all hairy, and consisting of four joints, and each has a pair of nippers, very hard, and have the appearance of red horn; it has two teeth in the mouth of the same substance, about half the length of a common pin, and they are crooked, and as sharp as needles: they have two small black, shining eyes, which are not much larger than pin's points: they make a bag as large as an egg-shell,

egg-shell, whose outer covering has the appearance of fine leather; but within there is a down as soft as silk, in which they lay their eggs: this bag is placed underneath their bellies, and they always carry them along with them: there is another sort like pine-apples, but not quite so big, and part of the hair on the top of the body is green: the inhabitants are very much afraid of this insect, and affirm, that it is more dangerous than a Viper. When they are irritated and put into a passion, they throw out a venom, which would render a man blind, if it should fall on his eyes; and even the hair of this insect is venomous, and if it is touched while alive, it stings like nettles. If it be taken up, and pressed never so little, it stings with a weapon not so big as that of a Bee but so venomous, that recourse must be had to the same remedies that cure the bites of serpents.

Bosman in his account of *Guiney*, tells us, that he met with a Spider of a monstrous size, with a long body and a sharp head, and broader in the fore part than behind, but not so round as most Spiders are. It had ten legs that were hairy, and as thick as a man's little finger. This Spider is called *Ananse* by the *Negroes*, who foolishly believe that the first man was made by this insect.

The *Bermudas Spider*, is of a very large kind, whose body consists of two parts, the one flat, and the other round, and they are so large when their legs are extended, as to cover a man's hand: they are beautifully variegated with divers colours, and they have an orifice on their backs, like those in the *West-Indian Spiders* already taken notice of: their mouths are covered with a sort of grey hair, intermixed with bright red, and they have a crooked tooth on each side, of a fine polished substance, extremely hard, and of a fine bright shining black colour: insomuch that they are often set in gold and silver to serve for tooth-picks. When these insects grow old, they are covered all over with a kind of brownish black down, which is very soft and smooth, and shines like velvet: the round part is much of the shape of a large pigeon's egg, and under that, which is flat, their legs grow, five on each side, with four joints and claws at the end: they cast their downy sloughs every year, as well as the two fine teeth above-mentioned: they live upon Gnats and Flies, and spread their webs from tree to tree, which are very large and strong. In the *Philosophical Transactions* it is said, that these Spiders will spin their webs between trees that are sixteen yards distant from each other, which they do by spitting their web into the air, and the wind carries it from tree to tree: this web when finished, will catch a bird as big as a Thrush, if this account is to be believed; but we are of opinion, that most readers will think it to be altogether improbable.

There are many sorts of Spiders in the *East-Indies*, of a very different bigness, some of which are four inches long, and have very thick legs. Others have eight feet, a thick speckled body, and a round head, with brown legs: these have two teeth like hooks, wherewith they bite very strongly: they make tooth-picks with these teeth, in the same manner as *Bermudas*.

At the *Cape of Good Hope* likewise, they have several sorts of Spiders, which differ in bigness, shape, and colour, as well as in the manner of making their webs. Some of these are venomous, and others not, and some delight to be in houses, while others keep always

in the fields. But there is a small sort, more dangerous than the rest; being no larger than a small pea, and it is black, and very active. It fixes itself on the walls of houses, or to planks, and in the fields it spins its web on the grass. Its bite is so venomous, that it would infallibly kill, without a proper remedy. A *Negroe* bitten by one of these Spiders, neglected the wound too long, and died in a few days: this insect likewise attacks pretty often, herds of large and small cattle, and does them a great deal of damage, for this reason the *Europeans* take a particular care in keeping their houses, and the stables clean, to preserve themselves and their cattle from the bites of these dangerous animals.

The large *Spider* of *South-America*, make their nests on guava trees, in the shape of the webs of some *Caterpillars*: their bodies are covered all over with hair, and they are furnished with sharp-pointed teeth, which give dangerous wounds; for at the same time they distil a liquor into them of a malignant nature: they generally feed upon *Ants*, and sometimes they will take the young of small birds out of their nests, and suck their blood. In particular, they are great enemies to the *Humming birds*, which they will often attack and kill: they shed their coats or slough's every year, like the *Bermudas* Spiders.

The small scarlet *Spider*, is a native of *England*, and is found in gardens and orchards, on the bodies of trees. It is not much bigger than a large *Flea*, nor is it divided into two parts, like most other Spiders; but it has a small round head, that stands from the body, furnished with two long feelers: the body itself is oval, and has three legs on each side; but though it is so small, it is accounted venomous.

The reddish chesnut coloured *Spider*, is very remarkable for its legs and feelers. It has eight of the former, four on each side, and each joint seems to be placed in a socket: the feelers are globular, and hairy at the ends, encircled with yellow, which gives them the appearance of a small stone set therein. It has eight eyes, placed in a semicircular form, and about them the colour is black, but the upper part joining to the belly, is of a reddish chesnut: the upper side of the belly is of a dark ash colour, and the legs are reddish.

The small long-legged *Spider*, is so finely marked, that it is impossible to describe it either in words or colours, there being so fine a mixture of green, red, and black, interchangeably put together in curious shapes. It has eight legs, which are very long, and marked in the same curious manner: the body is perfectly oval. It being without any divisions in the body, and the head does not stand out therefrom: the eyes are so small as not to be discerned.

The dark coloured *Spider*, has a broad streak of light hair-colour, in the middle of the back, and a mark of the same, in the shape of a diamond, on the upper part of the belly. It has six eyes, two clavated feelers, and eight long legs, which are finely spotted. It is divided into two parts, as other spiders, but the head is not distinct from the fore part of the body. In *June* it carries its egg-bag under its belly.

The house *Spider* with legs finely spotted with black, has hairs or bristles growing from each joint, and it has eight eyes, eight feet, and two clavated feelers: the fore part of the body is almost round, and that behind perfectly oval; some give the webs of these Spiders for the cure of agues.

The jumping *Spider*, that is one sort of them, is of a very small kind, and has eight eyes, placed in a circular form; and it is observable, that all those that have their eyes placed in this manner, catch their prey by jumping upon it, as a cat does at a mouse: the belly part of the body is of an oval form, and it has two clavated feelers, and four legs on each side, fixed to the breast. When beheld through a microscope, it appears to be beautifully variegated with black, chesnut, reddish, and white colours, all over the back, belly, legs, and feelers, and it is all over rough and hairy. Mr *Evelyn* found one of this sort near *Rome*, which was speckled with black all over the body, and through a microscope appeared like the feathers on a *Butterfly's* wing. It is very nimble by fits, sometimes leaping like a *Grashopper*, then standing still, and setting itself on its hinder legs, will very nimbly turn its body, and look round itself every way. If it espies a *Flie* at three or four yards distance, it will not make directly to her, but conceal itself as much as possible, till it arrives directly under her, and then creep slowly up to her, seldom missing its aim, and it jumps directly upon the *Flie's* back. But if in the mean time, the *Flie* takes wing, and fixes upon another place, it will whirl about very nimbly, by which means it always keeps its head towards its prey. It has been sometimes seen instructing the young one's how to hunt, and when any of the old ones missed a leap, it would run out of the field, and hide itself in crannies, as if ashamed. In short, nothing can be more diverting to a naturalist, than to observe the cunning and stratagems it uses in hunting.

The beautifully streaked *Spider*, is speckled with black all over its body and legs, which are very long. It has eight eyes, standing in the form of a segment of a circle; and it has two feelers very slender at their roots, and of a long oval shape at the ends. Both parts of the body are of an oval shape, and the tail is forked: there are two streaks on the back of the belly part, alternately spotted with white and black: the forks at the tail appear like feathers standing up, which it can open and shut like a fan, at pleasure.

The *Spider* with a transparent back and legs, has eight eyes, and the belly part of the body is vastly larger than the breast; on the back of it there is a dark space or mark, that runs two thirds of the length as far as the tail, and the back and legs appear transparent, like clear horns. It has two pretty long feelers, which are smaller at the root than at the end, and the legs which are long, are alternately variegated with different colours, though not very distinct, on account of their transparency, and there are four on each side of the breast.

The *Spider* marked with white spots and lines, in a curious regular manner, has yellowish and very hairy legs, spotted with a dark brown: the feelers also are spotted, and are short and thick at the ends: the breast or fore part, is very small, in proportion to the belly part, the back of which last is regularly marked with white spots. Near to the breast part there are four spots like pearls, placed exactly in the form of a cross, and where they meet, there is a small white one. Next to that there are two other spots, in the shape of pearls, placed transversely, in the middle of which, there is another small one. Near the back part there are three spots on each side, like half moons, and between them, others, placed in a very regular order. It has six eyes,

placed in an oval form, and may be met with in gardens, at the latter end of July.

The hair-coloured *Spider*, has on the upper side of the belly part, a yellow mark, in the shape of a cross, and round it there is a broad streak, of an oval shape: the legs are of a light hair-colour, spotted with black, and there are bristles of the same colour at the joints. It has two feelers, small at the root, and pretty thick from above half-way to the ends; the belly part is oval, and the breast part square, and it has six eyes.

The *Carter*, or long-legged *Spider*, has legs of a prodigious length, and there is no distinction of the back and belly part, for the whole body appears to be nearly round, and marked with ten spots about the edges: the feelers are small at the root, and become gradually thick to the ends: there are two particularities belonging to this *Spider*, which may be discovered by a microscope; one is the curious contrivance of the eyes, which are only two, and placed on the top of a small pillar or hillock, rising out of the middle on the top of its back, or rather the crown of its head; for they are placed on the very top of this pillar, back to back, with transparent pupils looking towards each side, but somewhat more forewards than backwards: they have a very smooth, and a very protuberant horny coat, and in the midst of it the very black pupil is seated, being surrounded with a sort of grey iris, and the pillar, or head and neck, seems to be covered with a crusty shell: these eyes do not appear to have knobs or pearls, like those of other insects.

The other peculiarity, is the prodigious length of its legs, in proportion to its body, which are jointed exactly like those of a crab, and terminated by a small case or shell, fastened to the body in a very wonderful manner, and which include a very large strong muscle, whereby this little animal is not only enabled to suspend its body upon these eight legs, but to move very swiftly over the tops of grass and leaves: the mouth is like that of a crab, the shell is speckled with a sort of feathers or hairs, and the legs also are hairy; in short it has some resemblance to a crab in most particulars, except the length of its legs.

The *Spider* called the *Phalangium*; is of a venomous kind, and is very large, but in shape it is like an *Ant*: the head is red, and the rest of the body black, speckled with white: there is another *Phalangium*, in shape somewhat like a black grape, having a round, black, shining, globous body, with very short feet or legs, which seem to be imperfect, and yet it can run very swiftly with them.

The common house *Spider*, has a round body, or rather oval, which is almost transparent: the colour is pale, and when it stands erect upon its feet, it is not unlike a painted star: the skin is soft, smooth, and polished, insomuch that some have imagined they have seen their own faces reflected from it: the legs are long, round, and slender, and of a very quick sense of feeling, being eight in number. It is not venomous, nor any way hurtful, for its bite will cause a sort of tickling, rather than pain: this is certain, that they may be safely taken inwardly, as country people often experience, when they swallow them for the cure of agues. When it is well fed, it will cast its skin, not once a year, but almost every month.

The rose *Spider*, so called, from weaving its web in rose bushes, has an oval body, and a small forked head, under the belly, and the back,

is marked with many white spots. It will grow in a short time, from the size of a small pea, to above an inch in length.

The brown *Spider* is somewhat transparent, when placed between the eye and the sun. It is to be met with in woods and hedges, and weaves a very thick web, that it may withstand the force of the rain and wind. It has a forked mouth furnished with feelers, over which, on the head, there are two small whitish spots, which perhaps may be the eyes, and the whole body is a little hairy.

The wild marjoram *Spider*, has a body as round as a ball, with its back marked with fifteen white spots, and the vent is of a quadrangular shape. It weaves a very rude sort of a web, among the leaves of wild marjoram.

There are three wall *Spiders*, which inhabit old walls, and the ruins of houses; they weave but small webs, and wander out in the day time, in search of prey, which they fall upon with great force, and drag them into their holes: the largest is of a dusky colour, with an oval head, and a round globous body, each side being adorned with two little short white lines, but about the middle of the back it is more whitish, and the legs are variegated with blackish spots: that of the middle size, is of a greyish colour, and on the middle of the back there are three white spots like pearls, and that next the neck is the largest and longest: the third is of a blacker colour, and the back is marked with a white right angled cross, for which reason, it is called by some, the holy *Spider*. In this particular it resembles one above described. It is of the leaping or jumping kind, and is very voracious, for it will lay up nothing for the next day.

The short black *Spider* carries a snow white egg-bag under its belly, and runs very swiftly; when this bag is broken, a great number of small *Spiders* come out, which go abroad in the day time to feed, and in the evening get upon its back, where they rest all night: there are jet black *Spiders* among rotten wood, and in the holes of trees, with very short feet.

The white *Spider*, has a compressed broadish body, of a white colour, and long slender legs: the forehead is marked with a spot, and each side with a reddish line: there are blackish red *Spiders*, with an oblong body, and a sharp tail; and there are red *Spiders* of two kinds, one of which lies in holes of the earth, and has a red breast, with reddish yellow feet, and the tail and body of a dusky colour, with a yellowish cast.

Linnaeus takes notice only of six *Spiders*, namely the greatest *Spider*; the house *Spider*; the bag-bearing *Spider*; the water *Spider*; the bird *Spider* and the Tarantula.

C H A P. XVII.

OF SCORPIONS, CENTEPEES, GALLY-WORMS, AND HOG-LICE.

A SCORPION is an insect with a body in the shape of an egg, which seems to be covered over with foot, and its tail consists of

several globous bodies or joints, the last of which is the longest, and is armed with a single or double prickle or sting, a little bent at the end. It has eight feet or legs, and claws not unlike those of a Lobster, armed with nippers: the head seems to lie hid at the top of the breast, with such small eyes, that authors take no notice of them.

Old authors take notice of seven kinds of Terrestrial *Scorpions*, the first of which is whitish, and not at all deadly; the second has a reddish mouth, and its sting produces heat, a fever, and intolerable thirst: the third is blackish, and its sting causes odd motions of the limbs, and a laughter like that of fools: the fourth is greenish, and its sting is attended with cold and shivering, and gives the patient a sense of being in very cold weather. It has eight or nine joints at the tail, which is the reason that it inflicts a deeper wound: the fifth is of a livid pale colour, with a large strutting belly; this not only strikes with the tail, but bites with a venomous tooth: the sixth is like a sea Crab, though it does not want a tail; but it has a large roundish body, which makes it look like a tailed crab: they are of various colours, some being black, others of an iron grey, and others green: the seventh is nearly in the shape of a crab, with two large nippers, and it lives in holes by the sea side. When it is boiled it becomes red like a Lobster.

The South American *Scorpions*, are in the shape of the *European*, but their sting is not so fatal, for the wounds they inflict are easily cured: they lurk in houses, behind old stools, benches, and chests, and are very large, some being five or six inches long: the translator of *Nieuhoff* affirms, they are five or six feet long; but this must needs be a mistake for inches. A Carpenter was stung by one in the *West-Indies*, when he was repairing a church, and it produced no greater disorder than the sting of a Wasp; it was soon cured by laying a compress on it dipped in rum: the females lay their eggs in a web, which they spin from their bodies in the manner of Spiders: the eggs are no larger than pins points, and they carry the bag along with them till they are hatched, at which time they get upon the back of the old one, which turns her tail over them, and defends them with her sting. However there is another sort in some of the islands, whose stings are much more dangerous than those of the former, for which reason they are very much dreaded by the inhabitants. It is certain that they change their skins, as Crabs do their shells, because there are many of them found quite whole, though empty, in the places where they used to lurk, except a cleft under the belly, through which their bodies come out.

At *Batavia* in the *East-Indies*, there are *Scorpions* a quarter of a yard in length; but those of a lesser size are so common, that you can scarce move a stool, bench, chest, looking-glass, or picture, without being in danger of being stung by them: the small ones are about a finger's length, and composed of many joints of the thickness of a goose-quill: the colour is yellow, variegated with brown streaks, and the fore claws have two sharp pinchers; their tail is long, and lies turned upon the back, at the end of which there is a sting, which sometimes does a great deal of mischief: they have eight long legs, not unlike those of a Cray-fish, and the sting is accounted mortal, unless prevented in time. Many believe that they are greatly pestered with *Ants*; but these are only the young *Scorpions*, that get upon the back of the old ones.

The *Scorpion* at the *Cape of Good Hope*, is from two inches and a half, to three inches long; and its colour is a greenish brown, speckled with black. It is in shape exactly like a Cray-fish, except the tail, which is more long and slender: the sting is very painful, and often puts a person's life in danger.

The *Scorpion* on the coast of *Guiney*, is upwards of three inches in length, and has four legs on each side, besides two claws armed with nippers, which make a very formidable appearance, they being very thick and strong, and between the nippers and the head there are three globous joints: the body consists of nine joints, and the tail of ten, which has a hooked weapon at the end, wherewith it stings: there are some on this coast as big as small Lobsters, and have the same sort of claws and feet; but their bodies are covered all over with long hair. Some of them have a small bladder full of poison, of half a finger's breadth, at the end of their tails, which they spirt out when they strike either man or beast, and the venom produces certain death.

The coal black *Scorpion*, is accounted the most venomous of all, and is very common in *Perfia*. It is of the thickness and length of a man's finger, and the body has some resemblance to an egg; but altogether it is shaped like a Cray fish, only it has a blunter head, and a less body. It has eight legs and two claws, with a long knotted tail, whose knots appear like so many little bladders, at the end of which is a very venomous sting. In some parts of *Perfia*, the inhabitants dare not sleep in ground rooms, for fear of these insects.

The *Barbary Scorpion*, when full grown, is six or seven inches long, its body is covered with a firm skin, which is brown, with a mixture of yellow, or flame colour. It is of an oval shape, and has small eyes, with eight legs, that are not very strong; each of these is composed of six joints, and terminated by a pair of sharp claws: the legs are paler than the body, and are a little hairy: the claws, with nippers, are like those of Crabs, and are large, and of a black colour, each of which is composed of four joints: the body consists of several joints, divided by denticulations, as is also the tail: the last joint is terminated by a pointed weapon, which is a little crooked, bending a little downwards, as in most of the other kinds.

Linnæus takes notice of four *Scorpions*, the *Indian*, the *African*, the *Italian*, and that of *Barbary*.

The *Centepée*, or *Centipes*, is so called, from its great number of feet, for which reason, in some places, they are called *Millepedes*, or thousand feet; but improperly, because that term is always bestowed upon Hog-lice by naturalists. In *Latin* the name is *Scolopendra*, and it is very common in many parts of the world, especially between the Tropics: there are several sorts of them in the *West-Indies*, one of which bites very dangerously; they are longer than a man's finger, and as thick as a goose quill, but more flat, and of the colour of rusty iron: they have a round head, with two small, but very sharp teeth, and the whole body is divided into ten or twelve joints, and as many transverse black lines; at the bottom of each of which there are two pretty long feet: there are two small horns on the head, and the tail is forked; they live among rotten wood, and when they are touched, they are sure to bite: the wound produces the same effect as the sting of a *Scorpion*, and the same remedies must be made use of to cure it.

The *Centepee* of the *East-Indies*, are about five or six inches long, the thickness of a man's finger, and of a ruddy colour: they consist of many joints and bones, and have two claws or pinchers, wherewith they wound as dangerously as the Scorpion, occasioning inexpressible pain: they lurk like them in holes, behind old chests and benches.

These insects are very common at the *Cape of Good Hope*, some of which are red, and others white; they are three inches long, and about half as thick as a man's finger: they are covered with hair, and seem to have no eyes; but there are two feelers on the head, which they make use of to find out the way they are to pass: this is a very venomous animal, and the bite is as dangerous as that of a Scorpion; a sailor that was bit by one on board a ship, felt an excessive pain, and his life was supposed to be in danger; however he recovered, by the application of three roasted onions to the part that was bit, and he soon was quite well.

The African *Centepee*, is four inches and a half long, and as thick as a swan's quill; the colour of the whole body is of a shining brownish black, and to each division or incisure a foot is annexed, of a yellowish colour, sixty on each side. If this insect should be cut in two, it is affirmed that both parts will live. When it is irritated it will bite very hard, insomuch that though a man has a glove on, the teeth will penetrate quite through. It has a forked mouth, and two feelers like the former.

The American *Centepee* has a flame-coloured line that runs down the back, and the sides resemble brass; it has a vast number of feet like hairs, and an exceeding small head; and they move so readily backward or forwards, that some have fancied they have two heads. Another that was brought from *Cape Augusta*, was somewhat larger than the former, and had seventy livid divisions or incisures, and twice as many feet.

The common *Centepee* is to be met with in *England*, and is about an inch long, with a flat thin body, of a brownish colour: the legs are short and yellowish.

The *Centepee* with thirty feet or legs, is not above half an inch long, and no thicker than a wheat straw: it is flat, and of a red colour, and the last pair of legs are very long, which makes it seem to have a forked tail.

Linnaeus has only three sorts of *Centepees*, that with seventy feet on each side, that with fifteen, and that with twenty.

The *Gally Worm*, is called in Latin *Julus*, because it is supposed to be like the catkins of walnut, and hale trees, which have the same name in Latin: they are a sort of short *Centepees*, and have more feet than any other insect, except them. Some of these are smooth, and others hairy, and one of the former was found on a cabbage-lettuce, about the thickness of a rush, and near two inches long. It had a black head, and a back of a golden yellow colour; the belly was of a blueish silver colour, with a great many feet, like hairs.

There is another kind quite black, except a white line that runs from the head to the tail, along the middle of the back: there is a third kind, of a dull yellow colour, only the head is reddish, as well as the feet; and the feelers, as well as the hairs near the tail, are livid: there is a fourth sort, of a reddish black; but the feet and feelers are of a lighter colour. Some of these lye hid in the mōs growing on the barks of trees, and others under stones, and among rubbish.

Mouset never saw but two of the hairy kind, one of which was somewhat above an inch long, and had a body that tapered from the head to the tail, and of a whitish colour, though the hairs were black, and very short: the other on the back and belly was of a somewhat livid colour, spotted with a disagreeable yellow; but the mouth was somewhat reddish, the eyes black, and the hair grey. It is found on decayed trees, between the wood and the bark; as also among stones that are covered with moss. They all when touched, contract themselves, or roll themselves up like a ball: they are not venomous, as is generally supposed, for they have been handled and irritated.

There is another sort that is very small, and is usually found about hollow trees, and stakes fixed in the ground. It is of the colour of brass, and has many feet; when it creeps along, it bends the middle part of its back like a bow, and if it be touched with a cane or stick, it rolls itself up: the body is slender, and some are above three inches long: there is another kind no thicker than a bristle, and of a light dun colour, and yet it has a vast number of small feet, and is near four inches long. It is to be met with among rotten timber and old rains.

The shining *Gally Worm* is sometimes to be seen on heaths, and may be discovered by its lustre, like a Glow Worm: these are not only found in *England*, but in *Germany*, and there is one much of the same kind in *New Spain*.

The brown *Gally Worm* has an hundred legs on each side, and grows to the length of two inches; the body is brown, and there runs a double iron grey line along the back, but the legs are of a paler brown: the back is roundish, the belly smooth, and the skin is somewhat glossy; the feelers are short, and consist of five joints. It is found a little below the surface of the earth, in the north of *England*.

The grey *Gally Worm* is three quarters of an inch long, and has an hundred and twenty feet on each side; its back is roundish, its belly flat, and its colour of a pale grey, only there are two iron grey lines on the back, and every joint of the body is streaked longways. It consists of about sixty joints, and has whitish feet. It is called by *Ray* the *Gally Worm*, marked with livid and white circles, and is found under large stones, and on old trees.

The red *Gally Worm* is an inch and a half long, with a very slender body, of a reddish colour: the back is almost flat, and the belly is quite so; but it has yellowish feet, with a red cast, which are seventy on each side. It is called by *Ray* the very slender long *Gally Worm*.

Linnæus has only three of these insects, that with seventy feet, that with an hundred and twenty, and that with ninety-six.

The common *Hog Louse* is seldom above half an inch long, and a quarter of an inch broad; the colour is of a livid black, especially when found about dunghills, and on the ground; but those that are to be met with under tiles, and in drier places, are of the colour of the hair of an Ass. It has fourteen feet, seven on each side, and they have only one joint each, which is scarcely perceptible. It has two short feelers, and the body is of an oval shape. When it is touched, it rolls itself up into a sort of ball, and the sides near the feet, are dentated like a saw. It is often found among rotten timber, and on decayed trees, for which reason it is by some called a *Wood Louse*: the eggs that they lay are white and shining, like seed pearls, and very numerous.

In winter they lye hid in the crevices of walls, and all sorts of buildings. When the eggs are first hatched, they appear like a sort of Worms of a whitish colour, and seem scarce able to stir; but they soon feed, and become very brisk: this insect is of great use in medicine, for it is very diuretic and aperient, for which reason it is good in the dropsy, and is often given with success for dulness of sight.

The water *Millepedes* is about half an inch in length, and nearly a quarter broad; the colour is a pale brownish grey, and the whole body is so thin it seems almost transparent. It consists of seven joints, besides the head and tail, and that at the tail is roundish, a little flat, and larger than any of the rest: the tail is forked, and each fork is divided into two parts at the end; the legs are slender, pretty long, of a pale brown and transparent, being seven in number on each side: the feelers consist of three joints each, and this insect is common in ponds and ditches.

The greater livid *Millepedes* is half an inch long, and of an oval shape, and is livid all over, except at the edges of the segments, which are whitish, and on each side there is a whitish spot near the hinder legs, and its skin is tough and glossy; its legs are short, and its tail blunt, being without any division.

The sea *Millepedes* is an inch long, and half an inch broad; it is of a whitish colour, with a roundish back, a flat belly, and sharp sides: the legs are seven on each side, and the three pair before are small and smooth, but those behind large, pretty long, and hairy on the sides. It has two pair of feelers, and the body consists of seven joints, besides the head and tail, which last is three quarters of an inch long, somewhat of a triangular shape, being marked with two convex parallel rays on each side.

In the *West Indies*, there is an insect, which the *French* call *Poux de bois*, that is Wood Lice, though they perhaps may be placed more properly among the Ants; for they only have their name from gnawing and eating holes in the wood that they fix upon: they are of a whitish colour, and are supposed to be a very great delicacy, because all sorts of small birds, domestic fowls, and little lizards, are very fond of them: they build in the earth a sort of small galleries or roads, a little larger than the barrel of a quill, in which there are so many turnings and windings, that at length the whole building makes a hillock as large as a kilderkin.

Within this habitation there is a sort of little republic, where they are secure from all the attacks of their enemies. If any breach is made in their walls, they immediately all set to work, to repair the damage as soon as they can, and it is a great pleasure to behold them so busily employed about it: the roads may be easily spoiled, by pouring oil of a Sea-cow thereinto, or even sprinkling it upon their whole building, for this will cause them to forsake their habitation. When these insects grow old, they begin to have wings like Ants, and then they have their places of abode in the earth, that is the hillocks which become black, dry up, and burn like a candle. Some call them Negroe's heads, because they are round, and seem to be curled like a Negroes head. Some surgeons make use of this earth, in the cure of dropsies, making the patient sweat, by means of the smoke that proceeds from it. The savages use it for baking their earthen pots, by placing them in it, and covering them with it on all sides; after which they set it on fire, and though it burns but slowly, it will bake them as well as if they were put in an oven.

C H A P. XVIII.

OF FLEAS, LICE, AND OTHER INSECTS.

THE *Flea* is so well known, that it hardly needs any description; however it may be observed, that it has a roundish body, that is blunt at the end, and a small head, with large eyes: the feelers are short, and are composed of four joints. When seen through a microscope, it appears to be all over adorned with a suit of curiously polished fable armour, neatly jointed, and beset with multitudes of sharp pins, almost like Porcupine's quills: the head on each side, is beautified with a quick, round, black eye, and it has six legs, the joints of which are so adapted, that it can, as it were, fold them up, one within another, and when it leaps, they all spring out at once, whereby it exerts its whole strength. Between the feelers there is a small probe or snout, and there are two jaws or nippers, somewhat like those of an ant.

The young Fleas are first a sort of nits or eggs, which are round and smooth, and from these proceed white worms, of a shining pearl colour. In a fortnight's time, they come to a tolerable size, and are very lively and active; but if they are touched at this time, they roll themselves up into a sort of a ball: Soon after this, they begin to creep like Silk Worms that have no legs, and then they hide themselves as much as possible, spinning a silken thread from their mouths, wherewith they form for themselves a small round bag or case, as white within as writing paper, but dirty without. In this they continue for a fortnight, after which the insect bursts out, transformed into a perfect Flea.

The *Louse*, when viewed with a microscope, is an insect of a very odd shape, with a prominent head, and two black shining goggle-eyes, looking backwards, and are placed where the ears stand in other animals, having several small hairs round about them. It has two horns where the eyes of most insects are usually seated, each of which consists of four joints, which are stringed as it were with small bristles: the head is very round and tapering, terminating in a very sharp snout or trunk, which has a hole, through which it sucks the blood. It has six legs, covered with very transparent shells, and jointed exactly like those of crabs, each being divided into six parts by these joints, and have here and there several small hairs. At the end of each leg, there are two claws, by which it is enabled to lay hold of the hairs on which it climbs: the belly is also covered with a transparent substance, and is grained all over, just like the skin of a man's hand.

Some have affirmed that a Louse will not live within the torrid zone, but this is a great mistake, for the Negroes that live in that climate, though they are almost naked, are generally full of them. One reason of which may be for want of combing their woolly hair, which cannot easily be done, it being so entangled together. Those in the *West-Indies*, make use of a sort of oil, with which they kill them, for otherwise they would be almost eaten up alive. However the white inhabitants in those parts, are not much troubled with them, on account of their changing their linen frequently; besides it is thought their plentiful sweats kill them.

The *Crab Louse*, is so called, for having some resemblance to the shape of a crab. It has a shorter and thinner body than the common sort. They seem to be generated in the pubes of those that are troubled therewith.

Besides these insects that infest men, most animals are said to have a peculiar sort; only the Fleas are common to many other creatures, particularly Dogs. However it is affirmed by many, that Asses are never troubled with either of these sort of animals, which some superstitious people pretend, is owing to the riding of Christ upon an Ass; but others with more reason affirm, it is because that animal seldom or never sweats. However they are both mistaken, because these vermin are not generated by sweat, as the ancients supposed, but proceed from eggs, which we call Nits, like other insects.

The Lion is said to be mightily infested with a sort of Lice in the hair over his eyes, and as is pretended, they plague him so much, they sometimes make him run mad. The Horses are well known to be troubled with vermin of this kind, which have red heads, and the rest of the body whitish: Those of Oxen and Calves are black, and they may be seen in great numbers on those that are lean: they are almost like the Lice of Hogs, only they are shorter, and a little thicker: Those of Hogs are so large and hard, that they can hardly be killed with the fingers. Dogs have some of these kind of animals, though very seldom, and they look like nits, with a whitish head; but the rest of the body is of a blueish black; they have been particularly taken notice of in Lap-dogs. The Lice of Sheep are very small, and have red heads, with whitish bodies; those of Goats differ very little from these. The Deer when they have shed their horns, are troubled with great itching in the eye-brows, which proceeds from Lice of the same colour as the head.

Linnaeus takes notice of several kinds of Lice, namely the common Louse, the Crab Louse, those of Oxen, those of Crows, those of Ravens, those of Thrushes, those of Starlings, those of Cranes, those of the bird called Avosetta, those of Turkeys, those of Fowls, that called the Death-watch, and two or three more; to which might be added an immense catalogue, if it was worth while to observe them.

The *Death-watch* has an oblong flattish body, of a pale brownish white colour, with an annular brown mark thereon, and a brown spot behind towards the vent: the head is oblong, the eyes are large and yellow, and the feelers are as long as the whole body: the size is about that of a common Louse, and there are spots all down the sides, of a reddish colour, that is one on every segment of the body. It has its name from the ticking it makes, resembling that of a watch, which some superstitious people have thought to have been a forerunner of death.

The *Monoculus*, or one-eyed insect, is peculiar to watery places, and has the legs or feet before, divided into branches, with which it either swims or leaps, and the body is covered with a crust or shell. It has but one eye, or more properly three that are placed close together.

The crustaceous water *Insect*, is very small, and is sometimes of a brownish, and sometimes of a reddish colour: the body is nearly oval, only it is smaller towards the tail, which is long, slender, and forked at the end, and under it on each side, there is frequently a large cluster of

of eggs, covered with a skin, of a yellowish colour, and often as large as the insect itself. It has two pair of feelers, and the eye is large, black, and placed in the very middle of the head. It is common in ditches, and other standing waters.

The testaceous water *Insect*, is covered with a shell of an oblong oval shape, and of a dusky brown colour. When it is taken out of the water, it shuts the shell close up, and resembles the seed of some plant; but when it is put into the water again, it opens like shell-fish, of the bivalved kind: the feelers appear from one end of the opening, and the legs from the other; the eye is large and black, and its motion is very swift. It is common in ditches, and other standing waters.

The aborescent water *Flea* of *Swammerdam*, is of a blood-red colour, and sometimes are in such multitudes on the surface of standing waters, as to make them appear all over red; whence many fanciful people have thought that the water has been turned into blood, and prognosticated some terrible misfortune. It has semicircular feelers, and a crooked tail.

The water *Insect* of *Frysch*, is without feet, and has a forked tail, like two bristles. Besides these, there are the short water insect, with semicircular horns, and a flat back: the long-bodied water insect: the small-eyed water insect, and the short water insect with a tail cloven into several parts.

The *Sheep Tick* is a small insect, which is common at the beginning of the summer in pasture grounds. It has a very compressed smooth body, covered with a tough skin, and is of a squareish shape: the colour is of a shining black, or of a blackish brown. When it fixes its head in the skin of any animal, and particularly sheep, it sucks out the blood, upon which it swells, and grows large and round in a very short time. Sometimes it sucks the blood of men, and cannot be got out of the skin without difficulty. It has six feet fixed to the neck, and a short but very sharp snout. It is an insect well known to country people.

Mouset informs, that some have mistaken it for the *Sheep Louse*, from which it is greatly different; for this has a longer snout, and the body is never so swelled with blood, as that of the *Sheep Tick*, but is always flat; besides the feet are of a dark reddish colour, and the back of an ash colour, marked with three exceeding small blackish points, and its shape is like that of a heart. It never thrusts its head into the skin, though it sucks out the blood by fits, and its excrements tinge the wool with a greenish colour, which is so lasting, that it can hardly be got out, by washing it with soap. They will live in a fleece after it is sheared, for a year together, which is a certain sign that it can live without blood.

The *Chegoie*, called by the *French Chique*, and by the *Spaniards Nigas*, is a very small black animal, which is met with in all places where there are ashes, and where they live nastily. It will penetrate pretty easily through thin stockings, and generally fixes under the toe nails, and the most prominent parts of the skin. The pain that it causes when it first enters is like the bite of a *Flea*; and after it is once got in, it eats into the flesh so gently, that it causes no more at first than a slight itching; it becomes bigger by degrees, till at length it is the size of a large pea, and then it produces Nits, which lodge about the old one, and increase in the same manner, if there is not care taken to get

them out; and then they cause putrefaction of the flesh round about them, producing malignant ulcers, and sometimes a gangrene.

These insects not only attack men, but Monkeys, Dogs, and Cats: the best way to prevent them from entering the skin, is to wear good stockings and to wash the feet often, particularly with sea-water.

There is an insect in the valleys of the province of *Popayan* in *South-America*, which though not particularly described, is proper to be taken notice of, on account of its dangerous effects. It is called *Coyba*, and is of a fiery red colour; its size does not exceed that of a middling Bug, and it is commonly found under stones, and among the grass. When this insect is crushed, or burst upon the skin of any animal, its venomous juices enter the pores, mix with the blood, and immediately produce a very dangerous swelling, the consequence of which, if no proper remedy be applied, is certain death.

The native *Americans* take the dried stems of a particular herb that grows in these vallies, setting them on fire, and singeing the patient all over, as soon as the body begins to swell. However if this insect be crushed in the palms of the hands, no bad effect will follow, which perhaps may be owing to the thickness of the skin. Instinct teaches the cattle that feed in these vallies, always to blow strongly upon the grass before they eat it; and yet notwithstanding which, the Mules sometimes happen to eat them, the consequence of which is always a swelling, and immediate death.

At *Martinico* there is another red insect, which is very small, and is generally met with in the savannahs or meadows, which are not very wet: they are no larger than a pin's point, and appear as red as fire; they get through the stockings, and fix themselves to the skin, where they cause a dreadful itching. Horses and others that graze in these pastures, have sometimes their head covered over with them, and then they rub them against stones and trees so roughly, that one would think they would tear their skins to pieces: to cure them the inhabitants make baths with odiferous herbs, wherewith they wash the legs and feet.

The cheese *Mite* has a roundish oval body, with a whitish smooth skin, and a small head: the legs, and parts about the mouth are a little brownish, and much harder than the body, on which there are hairs.

The *Louse* of the *Beetle*, is a very minute insect, with a reddish round body, covered with a firm hard skin, the head is very small, but the legs are pretty long, and the pair before are longer than the rest. It runs very swiftly for its size, and may be frequently seen on the bodies of Beetles, particularly the black Beetle, and other large insects. It is called by *Lister*, the yellowish *Louse* that infests Beetles.

The scarlet tree *Mite*, has a roundish body, and smooth shining glossy skin, which seems so swelled, as to be ready to burst; it is of a bright red colour, and has a very small head, with short legs. It is marked on each side with a small dusky spot near the breast, and there are a few hairs scattered over the different parts of the body. It may be frequently seen on currant bushes, running over the fruit.

The stone *Mite*, is of a bright red colour, with a round swelled body, and a small pointed head; the legs are pretty long, and of a paler red than the body; the feelers are much longer than in any insect of this kind. It is common upon old stone walls and rocks, and runs very briskly.

The scarlet water *Mite*, has a body of an oval shape, and a depressed back ; it is of a bright strong scarlet colour, and has a small head ; but the legs are pretty long, and are of a paler red than the body. It is common in small swift currents, where it runs very nimbly at the bottom. It is called by some the small red water Spider.

The itch *Mite*, has an oval lobated body, and a small pointed head ; it is of a whitish colour, and has two semicircular dusky lines at the back, but the legs are short and brownish. It has been sometimes found in the pustules of the itch, but is not the cause of it, as some imagine, for then it might be always seen therein.

The Scorpion *Mite*, has a roundish inflated body, of a whitish colour, and it is covered with a thin smooth skin, the head is very small, and of a dusky colour towards the mouth ; but it is most remarkable for having claws like those of a Scorpion. It is not uncommon in old rotten wood, and it is called by some the Scorpion Spider.

The little scarlet *Spider*, has a roundish body, or rather somewhat oval, with a depressed back ; it is of a fine scarlet colour, and the body is covered with a sort of down like velvet. It has a very small head, with two very little eyes, and the legs are short, and of a paler red, and there is a small black spot near the insertion of those before.

The shepherd *Spider*, is the largest of the *Acarus* kind, and has a roundish body, which is of a dusky brown on the back, marked with a darker spot, of a somewhat square shape near its middle : the belly is whitish, and the legs are extremely long and slender. On the back of the head there is a small eminence, furnished with a sort of double crest, which seem to be formed of many slender spines. It has two eyes, which are small and black. Some call it the long legged Spider, though it has only two eyes ; however it may be observed, that few authors keep exactly to that distinction.

Linnaeus also takes notice of an *Acarus*, that is hardly visible without the help of a microscope, and which is found on Chaffinches. It has a head like a cone, with the point cut off, and on its hinder part there is a segment almost separate from the rest of the body, to which belong two small crooked portions, and under it there is a longish brown spot. It has eight feet, consisting of different segments, and at the extremity of the fore feet there are four clear vesicles or bladders, which become flat when this insect treads upon any thing ; these are connected to a small long part, which seems not to belong to the leg, just where there are two strong prickles, which are supposed to enable this insect to adhere to whatever it treads upon : the two hinder feet are like those before, only the two prickles are wanting. But the feet that lye between the second and fourth pairs, are the most singular, for they are thick and shapeless, and have at their extremities, instead of vesicles, two saws, one of which is very short : the insect can move them, but not so nimbly as the rest, and therefore it does not use them for walking, but drags them after it like two tails : they seem to be designed to keep it close to the feathers of Birds. Several parts are hairy, and the hairs through a microscope, seem to be long and stiff, of a whitish brown colour.

Linnaeus has another kind of small insect, which he calls *Podura*, and the *French Puceron* ; in general they have a short roundish body, with a crooked forked tail, which assists its leaping, or rather it is entirely for that use, for it only walks with its legs, which are six in number.

It has two eyes, each of which consist of eight others. *Linnaeus* has only four sorts, the water *Puceron*, the snow *Puceron*, the grove *Puceron*, and the dung *Puceron*.

The common *Puceron*, is of the size of a Flea, and of a bright green, or blueish green colour: the body is nearly oval, and is largest and most convex on the hinder part; the breast is very small, and the head is blunt and green: the eyes may be seen very plainly, they being prominent on the fore part of the head, and of a shining black colour; near to these, there is a black line on each side, and the legs are very slender, and are all of the same length, and of a whitish green, but the feelers are crooked. Some call it the green Flea of plants. It is frequently seen on the stalks of orache.

The toad-stool *Puceron*, is of the size of a small grain of wheat, and it has a short roundish body, covered with a black glossy skin, and the vent is remarkably protuberant: the head is small, as well as the eyes, but the feelers are as long as the body, and black, with white ends.

The currant *Puceron*, is somewhat larger than a Flea, with a body of an oval shape, and a small head, furnished with little bright eyes: the legs are very slender, and the feelers long. It is of a grey colour, variegated with black lines and spots.

The *Puceron* with white legs, has a roundish body, of a deep black colour, with a small head, and eyes that are scarce discernible; the legs are short, slender, and white, as well as the forked tail. - It is common in woods, about old beech trees.

The water *Puceron*, is of the size of a small Flea, which it resembles in colour, being black and glossy, with a purplish tinge: the body is roundish, and the head small, the eyes very little, and the feelers short; but the legs are longer than in most of this kind. It is common in ponds, and other standing waters, and in calm days of the autumnal season, the surface is almost covered over with them.

Frysch observes, that the insect which the *French* call *Puceron*, is by the *Germans* named *Meeltan*, which is as much as to say Moth-dew; but he thinks they may be more properly called *Blat Læuce*, that is a leaf Louse: they all bring forth their young alive, and the fetus, when it is ready to be brought forth, entirely fills the belly of the female, and its fore parts are excluded first, then the hinder: the fetus does not begin to move till the horns or feelers appear out of the body of the old one; and by their motion it first shews signs of life, by moving them every way, and bending all the joints: then they begin to stir their two fore feet, as being most active, next to the horns; after this the middle feet, and those behind: the female lets the fetus stick to her hanging in the air, till its small and soft members become harder; but as soon as she finds that it has sufficient strength, she moves from the place where she was sitting, and as it were forces the fetus to stand upon its legs, and then she leaves it.

The weaker the leaves and buds of plants are, that is the less juice they contain, they are always more full of these kinds of Lice, insomuch that they are often quite covered with them. But they are not the causes of the weakness of the plant, but the sign; though it is true, that by picking and sucking it, they encrease the disease, especially of that leaf or bud whereon they sit.

As these insects are viviparous, they must necessarily lurk somewhere in the winter, where their bodies may be defended from the cold; but this is always near the trees or plants that serve to nourish them in the beginning of the spring; for they are always found thereon, as soon as the leaves and buds begin to open. However they do not hide themselves in the earth, like many other insects, because they have no part of their bodies fitted to remove the earth, nor are their feet so short, as to suffer them to creep into any chink; besides their bodies are so tender, that the least rough particle of hair would hurt them; nor yet is there any thing else which is common to other insects, that can enable them to conceal themselves in the earth. Hence it is plain, that they get into the chinks of the bark, and into the cavities of the stronger stalks, from whence they fall out upon the branches and leaves, when the warmth of the sun begins to be felt. Neither the cold of the autumnal season, nor the lesser degree of heat in *October* or *March*, ever hurts them; for which reason they do not seek for hiding places, before the fall of the leaves, by whose juice these Lice are nourished; however some hide themselves sooner, and some later.

They cast their skins like many other insects, four several times, and the males have wings, but the females have none: they have long legs, not only that they may be enabled to creep over the long hairs of plants and leaves but that they may travel from tree to tree, that stand at a distance from each other: their feelers consist of six joints, of which that at the extremity is roundest, and they have a very fine sense of feeling: the trunk or snout which lies under the breast, they thrust into the pores of the plant, to suck out the juice; for they do not gnaw them, but so hurt them by sucking, that the leaves become spotted, and as it were over-run with scabs, for which reason their edges always turn up towards the middle.

The breast is covered with a sort of square tick, so hard, as to resist the friction of the body against any thing when they creep: the two forward feet are placed before the horny Tick, near the neck, and the four hinder behind it. On the last section of the body, except one, there are soft horns on each side, which are sharper in some kinds, and blunter in others; but they do not move these like the feelers, and yet they have a fine sense of feeling, as may be easily known by touching them in the gentlest manner.

It has been said that these insects are often carried off, and devoured by Ants; but this *Frysch* could never observe: the Ants indeed are fond of those trees where there is a great number of these insects; but then it is only to suck the juice which flows from the leaves that have been lately bored; and this more particularly in the heat of the summer, when other moisture is wanting; but they never hurt or carry away any of these insects while they are alive, nor yet are they able, for when they find any Ants coming behind them, they will kick them away with their hinder feet.

The males have four wings, of which the uppermost are the largest, and those below least; the stripes made by the veins or nerves, are the same in all kinds of *Pucerons*, only there is some difference in the angles of their extreme parts. However there is one kind to be excepted which leaps like a Flea, and this is not what the *French* call a *Puceron*; for they differ from them in the stripes of the wings, as well as

in the mouth. But these insects differ from each other in their colour, which perhaps is owing to the quality of the juice of the trees and plants by which they are nourished: those that feed upon pot herbs and plumb trees, are of an ash colour, only they are greenish when they are young: those that belong to the alder and cherry tree, are black, as also those upon beans, and some other herbs: those on the leaves of apples and rose trees, are white; but as they leap like Grasshoppers, they are not properly placed among the Pucerons: the most uncommon colour is reddish; and Pucerons of this sort, may be found on the leaves of tansey, and their juice, when rubbed in the hands, tinges them with no disagreeable red: this may furnish a hint to the more skilful physicians, and botanists, for a farther examination; for it is very certain, that observations of this kind, may point out the way to useful discoveries.

The three principal and constant enemies to these insects, are first a sort of Flie, whose shape may be known from most authors, who have given an account of insects, and some have taken notice of their changes; however there is in none a very exact description of their nature: this Flie lays its eggs upon the leaves where the Pucerons are in the greatest number; there is generally only one at a time, which produces a worm, which with its sharp mouth, seizes upon the Pucerons that lie next it, and holding them up, suck their bellies, and afterwards devours them: the next enemy is a sort of worm, which though taken notice of by authors, has not been fully described; this devours the Puceron, not only while it continues to be a worm that has an oblong brown body, marked with red spots, and six creeping feet, but after it is turned to a small roundish Beetle, of no unpleasant colour, there are a great number of this sort, which differ in the colour, and the situation, and the number of the spots upon the wings: the third enemy is the Ichneumon Wasp, which is of a small size: this gets into the middle of the Pucerons, and with its horns seek for one of the plumpest of the females, and lays an egg upon her, from which a worm proceeds, that enters into the body of the Puceron through a pore: this done, the Puceron seems to adhere more strongly to the leaf with its claws, and so continues till the worm grows within its body, consumes all the juice, and so kills it: the colour of the skin is then changed into the whiteness of a pearl, to the shape of which the swelling body is not unlike; it then becomes harder, and defends the ichneumon worm against the injuries of the Ant. After seven days, the worm begins to creep; and this generation is performed twice every year.

The other kinds of *Podura* are, 1. That with feelers, consisting of numerous joints. 2. The short horned Podura. 3. The round bodied bright Podura. 4. The long bodied larger Podura. 5. The downy Podura. 6. The long legged Podura. 7. The lead colour Podura. 8. The small black legged Podura. 9. The very small white Podura. 10. The short bodied blue Podura. 11. The dusky greyish Podura. 12. The short tailed Podura. 13. The spreading tailed Podura. 14. The large headed Podura. 15. The long Podura with slender legs. 16. The slender horned Podura. 17. The larger water Podura. 18. The long bodied blueish water Podura. 19. The subterranean Podura. Part of these are to be met with on the branches of various bushes and plants, and the other part in ditches and ponds.

C H A P. XIX.

OF WORMS WITH NAKED BODIES, WITHOUT LIMES.

THE *Guinea Worm*, is so called, because it was first more generally taken notice of in that part of *Africa*, though it was mentioned long before, that is, by *Jenkinson*, in the year 1557, in his voyage to *Bogbar* or *Bucharia*. He says there is a little river running through the midst of *Bogbar*, whose water is so unwholesome, that it breeds worms between the skin and flesh of the legs, of an ell long: the surgeons in those parts take them out with great dexterity; for when the worm first begins to shew its head, they pull it gently out a little way, that is about an inch, and roll it up; the next day it will come out as much farther, and so on, till it comes quite out. But it does not kill the person when it breaks, at least not always, though he affirms the contrary; for they have been often seen to break in *Africa*, in drawing them out, and yet the patients have not died. It is about the thickness of the large string of a violin, and sometimes much thicker, and the colour is white and shining like silver. *Jenkinson* adds, that strangers are most pestered with these worms; but this is not true in *Guinea*; for many negroes are afflicted with them, while the white men generally escape: the manner of taking them out in that part of the world is to wait till the head appears through the skin; after which they draw it out a little way, making it fast to a stick, about which they wind a small part of it every day, till they have at length entirely brought out the whole, and then the patient is freed from pain. But if the worm happens to break, the negroe is put to a double torture, for it either rots in the body, or breaks out in some other place. Some negroes have nine or ten of them at once, and they are common all over the coast of *Guiney*: though some of these are an ell long, agreeable to what *Jenkinson* affirms, yet many of them are much longer, growing almost to the length of two ells: this worm is omitted by most of our modern writers; and those that do mention it, give a very erroneous account thereof, affirming that it is no thicker than a horse hair, and of a pale yellowish white all over, except the head and tail, which are black and glossy: the head indeed is of a pretty dark colour, but the tail is of a filvery white, like the rest of the body. It is pretended that doctor *Lister* has seen many of them alive in the body of a black Beetle; but it may be doubted whether the physician took it to be the *Guinea Worm* or not, for certainly he could not be guilty of so egregious an error; for if it was a native of cold climates, we should certainly meet with it in the legs of the inhabitants, especially in the hot seasons of the year. *Bucharia* is not indeed within the torrid zone, but the heats in that country are sometimes very excessive. Dr *Friend* was the first *English* physician that took notice of it in his history of medicine; but he did not seem to know that *Jenkinson* had mentioned it before. It has also been observed by other travellers that have been in hot countries, and therefore it is very strange that no better account of it has been given hitherto by *English* writers.

The earth *Worm*, is of an oblong form, and is like the round *Worm* that is bred in human bodies: the largest sort are six inches long, and may be stretched to be a foot in length: they are of a reddish flesh colour, and most of them have a ring round the neck, or rather a sort of a necklace, in which there is a little blood. Some of these sort have been seen ten inches long, and above an inch in diameter: this is by some called the lob *Worm*, and the dew *Worm*, and is to be met with in gardens and other places, by the assistance of a lanthorn, late in a summers evening. In great droughts they never appear, and therefore if any of them are wanted as baits for fish, they may be forced out of the earth, by pouring the juice of walnut tree leaves, mixed with a little water and salt, into their holes.

The *Brandling*, *gilt tail*, and *red Worm*, are all to be found in old dung-hills, or the rotten earth that is near them; but the best for fishing, are those found in tanners yards, under the heaps of bark, which are thrown out after they have done with it; but the *Brandling* is most easily found in hog's dung.

The marsh *Worm*, is to be met with in marshy places, near the banks of rivers, and is of a bluish colour: the Tag-tail is of a pale flesh colour, with a yellow tag on its tail, almost half an inch long: they are to be found in fields that have been manured with marle, and in meadows after a shower of rain. *Mouset* observes, that Worms in general are of a more whitish colour, after heavy showers of rain: they have the parts of generation belonging to both sexes; but they do not wind about each other like Serpents, when they are joined. When a lob *Worm* has been opened, there has been found a sort of an annulated gut, covered with a thin membrane, which had a very strong smell: the eggs lye over the gut near the mouth, and they are of a whitish colour. Some suppose that they feed chiefly upon earth, because there is always some found within them when they are opened; however it is certain they are fond of crumbs of wheat bread, and will feed upon them greedily when they lie in their way. Many of them are destroyed in very dry summers, and by the cold in winter: they are very often so numerous in gardens, that they do a great deal of mischief; but they may be easily taken and destroyed, in the manner above mentioned.

The sea *Worm*, is above a foot in length, and as thick as a man's finger. It is of a pale red colour, and composed of rings, or annular joints, like the earth *Worm*; but the skin is rough, for all the skin is covered with little prominences. It is found in the mud upon the sea shore, and serves for food to many sorts of fish: the common earth Worms in Peru, are larger than these, for they are as long as a man's arm, and thicker than the thumb.

The round *Worm*, bred in the intestines of a human body, consists of rings like the earth *Worm*, it being without feet, and much of the same shape; but it differs from it in being of a white colour: they are not only bred in the guts, but in other parts, and particularly in the heart, for there are instances of their having been found therein: they have also been met with in the guts of horses, oxen, calves, dogs, hogs, and hawks, besides many other animals, insomuch that it is hard to say whether any species of animals are free from them or not: they cause various disorders and diseases in human bodies, for they not only produce pain, but consumptions, convulsions, fevers, and pains like

the pleurisy. There is another sort, that have a snout or trunk, with a kind of crooked claws, wherewith they sometimes gnaw and tear the membranes of the stomach, causing inexpressible pain, anxiety, and a stinking breath; but they more generally reside in the gut called the ilecum, because it is free from the gall, for they cannot bear its bitterness: the bellies of children are sometimes strangely distended with them, and they render the excrements like cow dung, and full of substances, like cucumber seed; the round Worms are generally of the length of a palm, or longer; and yet a certain blacksmith threw one up by vomit, a foot and a half long, with a red smooth head, about the size of a pea, and the body, was covered over with a sort of a down, with a tail in the shape of a half moon. At *Rome* a man afflicted with Worms, which gave him inexpressible pain, at length voided one that was black and hairy, of the length of five feet, and about the thickness of a reed. Another brought away one not above a palm in length which was pretty like the round sort, only the back of it was covered with red hair or down: they have been seen of all colours, as red, yellow, black, and variegated with white and black; but of these the green are most uncommon. However these are all uncommon productions, and never have yet been placed by naturalists in any regular class.

The *Ascarides* are also Worms bred in a human body, and some pretend they have seen them in the mud, at the bottom of rivers and ponds. It is of an oblong form, slender, and covered with a very tender soft skin, and are not unlike book Worms. It is of the thickness of a small pin, with a small sharp head, and a pointed tail: there is always a vast number of them together, and they are sometimes voided out of human bodies in large quantities: their seat is in the great guts, and particularly the rectum. They produce inflations of the belly, sickness, and leanness, and are attended with great itching of the anus. Some of these Worms are larger than others.

The tape *Worm* grows to a surprising length, being sometimes two or three ells or longer, and it is divided throughout its whole length by knots or joints. Some have formerly thought that it was the inward skin of the guts, which comes off throughout their whole length; but this is a mistake, for it has been sometimes seen to move after it was voided. It has somewhat the appearance of the links of a chain, the joints being a third of an inch long, and the skin is smooth, and of a whitish colour. It is found in the intestines of many other animals, besides men, not excepting birds and fish. In the year 1725, it was epidemical among the geese in *Germany*; some of them were voided a foot and some inches in length, with the dung, and many of the geese were cured by accidentally feeding upon the remains of sage and hyssop after they were distilled. There have been fish opened, that have not only one tape Worm, but three at a time, and these three times the length of the fish themselves. Mr *Frysch*, a *German*, who gives us this account, affirms, that these supposed joints are real knots, which he has been at the pains to untie, which when done, rendered the Worms a great deal longer. He farther observed, that they had a sort of an artery, which run from the head to the tail, and was plain enough to be seen, it being of the colour of blood, and the body itself white: the breadth of the body grew less and less to the end of the tail, and end-

ed in a sharp point; and the mouth, or fore part, which it could draw in, was formed in such a manner, that it appeared to be cut off.

In the bowels of the fish that have tape Worms, there have been found small creeping Worms upon the liver, almost an inch long: they had the same colour and shape as earth Worms: these, when they have been thrown into cold water, have been seen to swell, to grow stiff, and to enlarge themselves, so as to break the skin of the Worm; and then the dead tape Worm has been found to lye at the bottom, thrice the length of the former.

Mr *Frysch* has been as careful in examining the Worms of a human body, and he affirms, that they consist of three parts, the outermost of which is the skin, and the innermost two guts, one long, and the other short: the skin is thick, and besides the aperture of the mouth, no hole can be found in it: this mouth is most distinct in the lesser sort, and the lips may be plainly seen, by which it adheres to the intestines like a Leech: the greater have a hooked mouth, and somewhat in the shape of a blunt wedge, which is very hard; and with this hook it sticks so close to the inward cuticle of the intestines and pylorus, that a tubercle or callus may be seen here and there thereon: the nearer the Worm is to the stomach, the callus is always the greater, especially in sows, to the middle of which the head of the Worm sticks by its hook, in such a manner, that the descent of the aliment from the stomach, though never so plentiful, could not force it off: the tail or lower part of the Worm is solid, for the cavity of the belly is not continued to the extremity. It has no vent, or one so small, that the excrements could not be forced out by pressing the body; but from the mouth it will void when touched gently, a sort of a watery liquor, that is found in the belly, where there is a space between the two guts, especially between the navel and the mouth. He calls a sort of ligament the navel, which is the sixth part of the body in length from the mouth, and keeps the long gut suspended by its middle and fuller part, least the watery liquor that lies about it, should fall into the lower part of the belly, and press the finer parts that are not so full. By this longer gut, which may be likened to a stomach, the Worm is nourished with a pure and white juice, like chyle: the short gut seems designed for the excrements, it being full of matter, that smells like the human fæces; this is black, and has no fold or bending.

When these Worms are ready to undergo their transformation, they are fuller of this white fluid, and appear of a more shining white; but the lesser become more red, and are much of the colour of the skin: this white gut, which is the principal inner part of the Worm, he supposes to be the tape Worm, which receives its nourishment in the skin of the former, till it is come to a proper size, and then it casts its slough, much in the same manner as a Butterfly: the tape Worm is always three times the length of the former Worm, and is of a white colour; and he has often seen these Worms that have been killed by mercury, voided with the skin broken as above; and what confirms this conjecture is, that those found in fish, when thrown into cold water, which breaks the skin, always produces tape Worms, three times the length of themselves: these Worms, that is before they are changed, do not seem to have any parts of generation, which are plain and evident in earth Worms.

The gourd *Worm*, is two thirds of an inch in length, when full grown, and its breadth is nearly equal to two thirds of its length: the skin is soft and whitish, with a tincture of brown; and the shape is flattish, but a little rounded on the back, and it has two rows of eight deep longitudinal furrows: the hinder part of the body is roundish, and at the other extremity it has a large mouth. It is not unlike the seed of the common gourd, from whence it has its name. It is sometimes met with in the intestines of men, and other animals.

The common *Leech*, is a water insect, having the figure of a large Worm, and it is as long as a man's little finger: the mouth is furnished with three sharp strong teeth, with which it is capable of piercing, not only the skin of a man, but also that of a horse and ox. It has a small head, and a black skin, edged with a yellow line on each side, and the belly is a little reddish; it has also some yellowish spots on the back. It produces its young alive, which is only one at a time, in the month of *July*. It is made use of to draw blood, and must be kept in clean water a few days before it is made use of for that purpose: they will suck the blood till they are almost ready to burst, and then fall off; but they will sometimes continue on too long, and then if a little salt is thrown upon their bodies, they will let go their hold.

The horse *Leech*, is larger than the former, and has a smooth glossy skin, black on the back, spotted with grey: the belly is of the colour of these spots, with a tincture. It is common in ponds and rivers.

The snail *Leech*, is about an inch in length, and of a very flat shape; its skin is smooth and glossy, and of a whitish colour: the back is a little raised, and the sides so thin, and they look as if they had an edge. It is common on stones, and at the bottoms of puddles of water.

The broad tailed *Leech*, grows to an inch and a half in length, and has a smooth glossy skin, of a dusky brown colour: the back is raised into a sort of ridge, but the belly is flat, and the tail remarkably broad, with which it sticks to stones very strongly. It is common on stones in shallow running waters.

The black naked *Snail*, is somewhat in the shape of a cylinder, and perforated on the side; and it has four feelers, on two of which there seem to be eyes. It is about three inches long, half an inch in diameter, and the head and tail are smaller than the middle; the back is convex, the belly flat, and the whole body is furrowed and wrinkled very considerably. It is all over of a deep black colour, except the belly, which is somewhat grey: the feelers are not always visible, for it thrusts them out occasionally, and the body is covered with a sort of slime, somewhat like that of an *Eel*. It is of both sexes, and can impregnate, and be impregnated at the same time. It is common in the woods, and under hedges, and is sometimes seen in cellars, and other cool places, especially in damp weather.

The reddish *Snail*, is about two inches long, and is smaller in proportion, than the black *Snail*; its body is covered with a great number of slight furrows or wrinkles, and it is all over of a dusky red except on the belly, where it is of a light grey. It is covered with a thick slime, and moves along very slowly, always leaving a track behind it, made with the slime, which dries into a thin glossy film.

The yellow spotted *Snail*, when full grown, is about an inch and a half long, with a prominent back, a hollowish body, and a small head.

All the surface is slightly furrowed or wrinkled, and covered with a slimy juice; the colour is of a glossy yellow, with a brownish cast, and is all over variegated with spots of a greyish colour. It is very uncommon, though it is sometimes seen in the woods of the north of *England*.

Besides these, there are the large grey *Snail*, spotted with a dusky brown; the little short grey *Snail* without spots, the reddish brown *Snail* with a reddish body; the small dusky brown furrowed *snail*; the deep chocolate coloured *Snail*.

C H A P. XX.

OF SHELL SNAILS.

A Shell *Snail* has a single valved spiral shell, which is very hard, and light at the same time; by the help of this, the animal is defended from all injuries, and can carry its house or lodging with it wherever it pleases. At the beginning of winter it retires into a hole, and then a sort of slime or glew proceeds from its body, which entirely shuts up the mouth of the shell. Under this shelter it passes the winter, like many other insects, without trouble, and without want. When the spring appears, and the warm weather comes on, the *snail* opens the door of its house, and roves abroad to seek its fortune. It is obliged to move along, and that very slowly, as it always carries its shell upon its back; and being thus obliged to crawl along, if its eyes were placed low on the body, which is dragged on the earth, it could not see the objects it is in search of; at least they would be exposed to dirt and mud every now and then; for this reason, nature has provided it with four eyes, which may be likened to telescopes, wherewith it may see what is doing all round about it.

Some have imagined these eyes are horns, and yet they are in reality four tubes, with a glass at the ends; but to speak more properly, they are four optic nerves, on each of which there is a very beautiful eye; and many imagine this to be the case of *Snails* without Shells. It not only lifts up its head to look about, but it raises up the optic nerves still higher, with the eyes placed at the ends; for it can lengthen and direct them at pleasure.

However, authors are not wholly agreed about the reality of this, for some think that the shorter horns are only the organs of smelling. But be this as it will, the eyes on the other two are very plain to be perceived. One would at first imagine, that any discovery it can make would be of very little service to this insect, since it is without legs; however instead of these, it has two large muscular membranes or skins, which it can contract or lengthen at pleasure. It first wrinkles up the skin before, by which it drags the hinder part after it; then it contracts or wrinkles the skin behind at the same time, extending that before, which being repeated alternately, this animal can crawl along with ease. But perhaps some may think this mechanism is not sufficient for its purpose; for as it has no wings to fly, when it meets with danger,

danger; it seems to be exposed to falls from the brink of precipices, or into the water, and then it would certainly be drowned. However, to remedy this, nature has provided it, very plentifully, with a thick clammy liquor or slime, which will secure it from falls by its gluey quality; nor yet can it be hurt by rain or moisture, because it has an oil that stops up all the pores of the skin. It seems to know the great use this oil is of, for which reason it takes care that the sun should not dry it up, and as for moist places those cannot do it any harm.

Hence it is plain, there is nothing to hinder its going in quest of nourishment; and when it has found any, it has two mouths armed with teeth, with which it sometimes does a great deal of damage to the very best fruits, to the tender buds of plants, and even to leaves on which the preservation of the fruit depends.

But what is most wonderful in these animals, is, that they are all hermaphrodites, and have at same time the parts of generation of both sexes, insomuch that they usually fecundate each other, as was before observed in treating of the naked snails: they have a sort of courtship, and when that happens, one of them lets fly a sort of a little arrow at the other, which has as it were four wings, or rather four edges: this arrow is entirely separated from the snail that darts it, and it either pricks the other, or falls to the ground, after it has performed its office: the other snail darts his at the other, but this mock fight is immediately followed with a perfect reconciliation: this dart consists of a substance like horn, and they are always to be met with near them at the time of their conjunction, which happens three times in the year, and in the space of six weeks, each of them after this, in eighteen days time, goes to deposit its eggs in the earth, and covers them with a great deal of care.

When the eggs are hatched, and the young Snails appear, they have each of them a shell, which increases as their bodies increase; for at first it is of a size proportionable to its small inhabitant: this shell is as it were the rudiments of that which is so visible afterwards to the naked eye; but as the body of this insect cannot grow longer, except towards the opening, it is likewise that way that the shell receives its increase: this is done by the substance that is in the animal's own body, and it is composed of a sort of a glue, and very fine stony particles: these substances pass through a multitude of small canals, and at last reach the pores, which are very evident on the surface of the body. When the animal perceives that all the pores are shut up under the shell, it directs them towards the parts of the body which lye out of the shell, and are quite naked: these sandy particles and glue, transpiring outwardly, there grow thick, and adhere to, and dry on the edges of the shell. It forms at first a simple skin, to which it fixes another, and then a third; and when all these layers are united, they form a substance exactly like the rest of the shell. As this animal increases, and its body is not sufficiently covered, it continues to transpire, and build again in the same manner: this is certainly the method by which it fashions, builds, and repairs its house; for if you take Snails and break their shells, without hurting their bodies, and then put them under glasses, with earth and grafts, you will soon perceive that part of their body which is left quite naked, will soon be covered with a kind of froth or sweat, which proceeds immediately from the pores: this sweat or froth is soon pul-

ed forward by another underneath, and so on, till it comes to be on a level with the old shell.

That you may be certain that this shell proceeds from the pores, you need only take film on the inside of an egg-shell, and slide it gently between the body of the Snail, and the extremity of the fracture, and you will find the shell continue in the same state as it was after it was first broken; and still to make this more plain, you will find that the substance which was to repair the shell, will stick to the film, and there form another shell.

The great garden *Snail*, is the largest of the common sort, it being about three quarters of an inch in height, and as much in diameter, and the body of the shell is rounded: the mouth of the shell is large, and nearly round, but it is in part filled up by the succeeding turn of the shell: the clavicle or tail, has four turns, and is blunt at the extremity: the colour of the shell is of a dusky brown, except a broad streak which runs along it, following the spiral turn of the shell. Sometimes there are two others more faint, and above and below that in the middle, there run several broad and short oblique lines or clouds, of a different brown. It is almost every where to be met with in the spring, in the gardens and orchards throughout *England*.

The brown clouded *Snail* with a round body, was not a native of *England* till very lately, it being originally brought from *France*, as a medicine for a gentleman; at which time many of them were turned alive into his garden, from whence the adjacent parts have been furnished with them: that is in the county of *Surry*. It is above an inch in height, and as much in diameter, and the shell is considerably firm and strong. Its colour is of a deep dusky brown, variegated with clouded spots, and oblique streaks, of a paler colour: the body of the shell is rounded, and the mouth nearly round, only a part of it is filled up by the succeeding turn of the shell: the clavicle is high, and has four turns.

The yellow *Snail* with a round body, is about three quarters of an inch high, and as much in diameter: the body of the shell is rounded, as in the two former kinds; but the mouth is more depressed, and the clavicle has four turns, and is terminated by a little round button: the shell is considerably thick and firm, and the general colour is of a dusky yellow, only it has a single broad streak of a deep brown, following the spiral turn of the shell, and placed exactly in its middle. It has also some other faint variegations of brown, and the mouth is surrounded with a thick rim of white. It is not very common, but may be met with under hedges in the west of *England*: there are three other sorts of the common large Snail, namely the brown and white Snail, with a depressed clavicle: the great brown Snail with a few variegations, and a raised clavicle; and the large blueish Snail.

The plain yellow *Snail*, is of the smaller species, it being no more than half an inch in height, and about as much in diameter: the body of the shell is not so distinct from the clavicle, as in the larger sorts, and yet there may be five turns, which are easily discovered in the whole shell, and the clavicle rises from the rest of the shell, but it has a blunt termination: the mouth is large, and is nearly round, but it is depressed, and is partly filled up by the succeeding turns of the shell: the colour is generally of a plain bright yellow, without variegations, only

only the lip or verge of the mouth is of a lighter colour than the rest, being sometimes whitish. It is every where to be met with in gardens, orchards, and hedges.

The yellow *Snail*, has a very beautiful shell, which is nearly half an inch in diameter, and almost as much high. It consists of five turns, and has a depressed mouth, with a whitish rim or lip: the colour of the shell is yellow, only along all the spiral turns, there runs a broad streak, of a deep purplish brown colour: this is also to be met with in gardens, orchards, and hedges.

The yellow *Snail* with three streaks, is near half an inch in diameter, and as much high, with a roundish depressed mouth: the shell is composed of five turns, and the clavicle terminates in a button: the general colour is yellow, except the three streaks, which run along the spiral turns of the shell, of a purplish brown colour: the middlemost of these is broad, and the two outermost narrower, this is also common in orchards, gardens, and hedges.

The yellow *Snail* with four streaks, is of the same size as the former, and has the same number of turns, and it has likewise a button at the extremity of the clavicle: the mouth is large and roundish, but depressed and encompassed with a thin rim, of a whitish colour. The general colour of the shell is yellow, only there are four narrow streaks or lines, of a purplish colour, that follow the whole spiral turn of the shell, running along the middle thereof: this may be easily met with in fields and gardens.

The yellowish *Snail* with five lines, is of the same size with the former, but has a thinner shell, which is very brittle, and the clavicle terminates in a whitish button: the mouth is large and depressed, and is encompassed with a thin whitish lip, the general colour of the shell is a whitish yellow, according to its spiral turn, there run five streaks or lines to the top of the shell, through the center of each turn: they are not so plain as in the former.

The flesh coloured *Snail* is one of the depressed kind, and is near an inch in diameter, and yet no more than the third of an inch high; the shell consists of four spiral turns, and the clavicle, which is very flat, is roundish at the extremity: the mouth is large, roundish, and encompassed with a thin round lip. It is of a faint reddish or flesh colour, and is beautifully radiated with a deep purplish brown: this *Snail* is common in *Germany*, and it is said to have been seen on the bushes in *Lancashire*.

The whitish flattened *Snail*, is about three quartes of an inch in diameter, and more than a third of an inch high. It consists only of three spiral turns, and has a roundish depressed mouth, encompassed with a thin rim: the general colour is a pale whitish grey, only it is faintly radiated with lines and clouds of an obscure purplish brown. It is common in *France* and *Germany*, and some say it is to be met with in *Yorkshire*.

The whitish depressed *Snail* with a dentated mouth, is about half an inch broad, and its height no more than the third of an inch. It consists of three or four spiral turns, and has a flat clavicle: the mouth is above a quarter of an inch long, and about as much broad, which makes the figure nearly roundish. It has a pretty broad lip, of a pearly white, and is slightly dentated on each side: the colour of the whole

shell is whitish, without any variegation. It is said to be met with in *Charlton* forest in *Suffex*, and is pretty common in *Italy*.

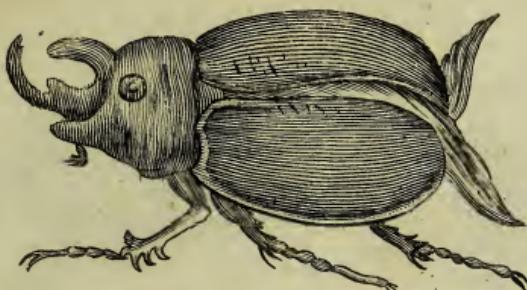
The *Jamaica ribband Snail*, is an inch and a half in diameter, and yet is not above half an inch high: the shell consists of three or four spiral turns, the outermost of which is considerably large, and the rest grow gradually smaller, as they approach the centre: the clavicle is very little raised, and has a blunt termination: the mouth is roundish, and the general colour of the shell is of a pale brown, except a white streak or stripe, that runs according to the spiral turns of the shell, which is of a white colour, and appears somewhat like a ribband.

The white depressed *Jamaica Snail*, is about an inch and a quarter in diameter, and about the third of an inch high: the shell consists of four evident turns, but the clavicle is very little raised, and it has a blunt termination: the general colour is white, only there is an orange coloured streak runs along all the spiral turns: the mouth is placed transversely, and has a very large and broad lip, deeply dentated on both sides.

F I N I S.



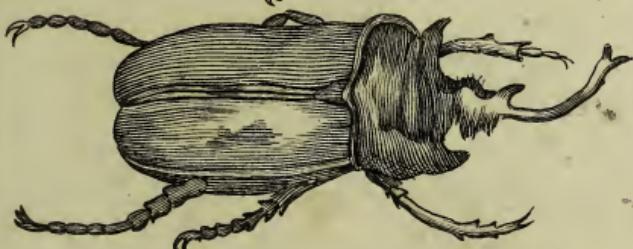
Elephant Beetle.



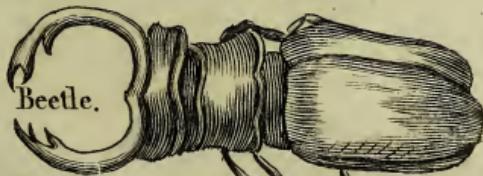
Rhinoceros Beetle.

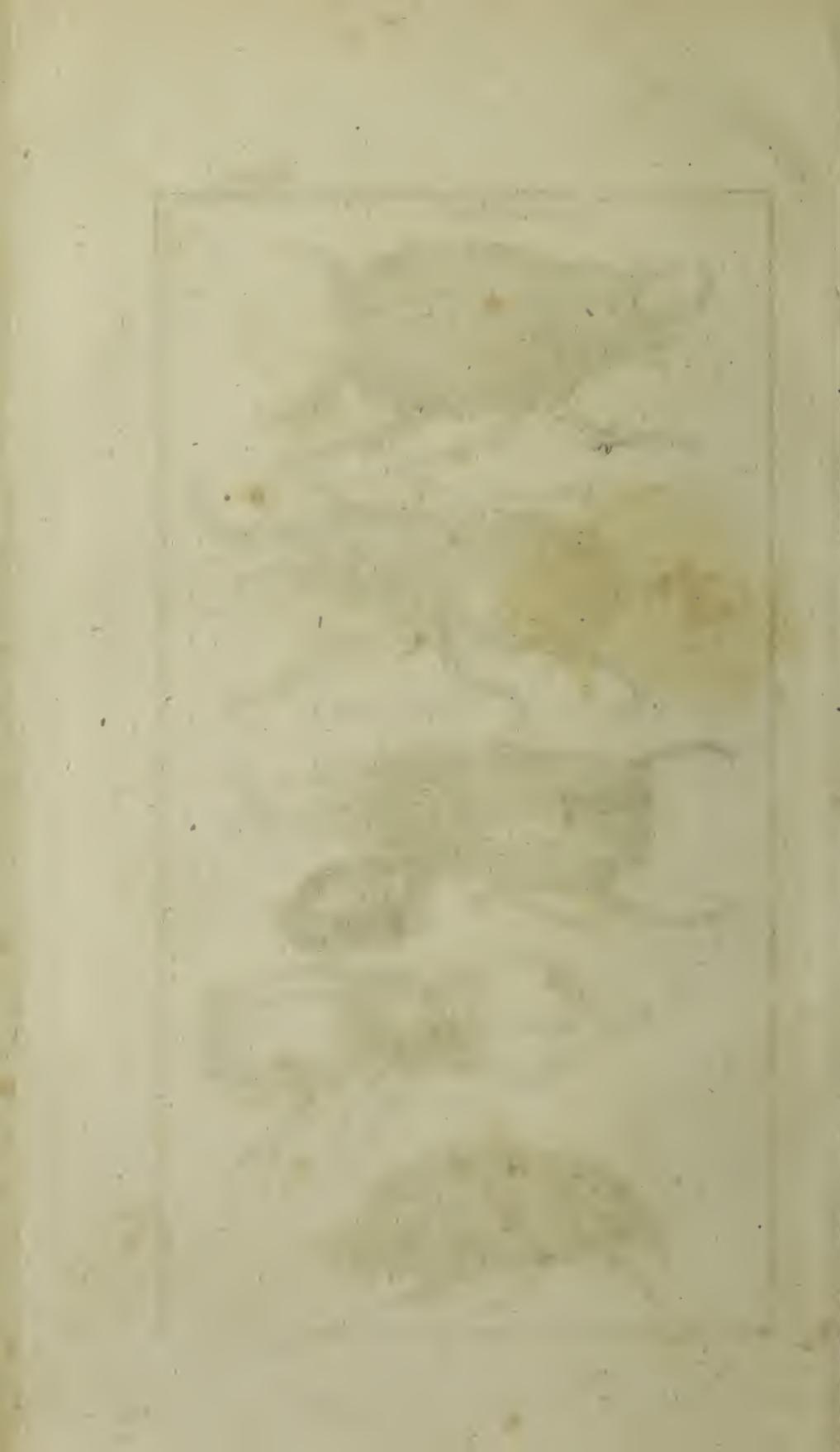


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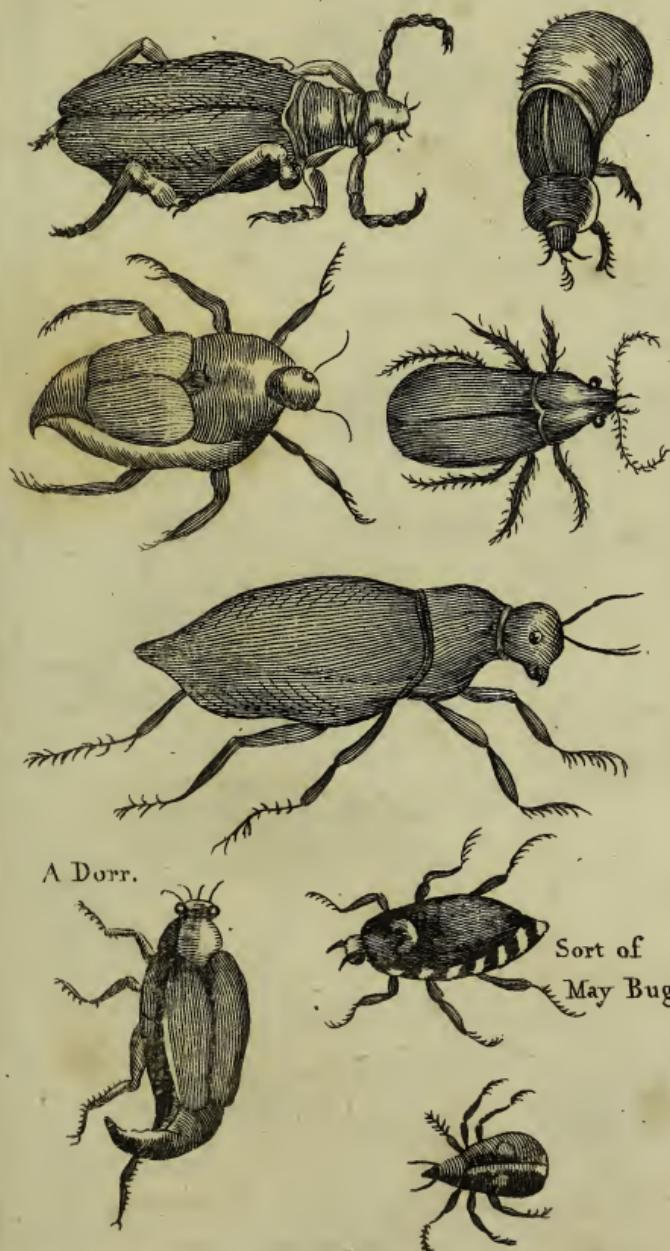


Stag Beetle.





Several sorts of Beetles.

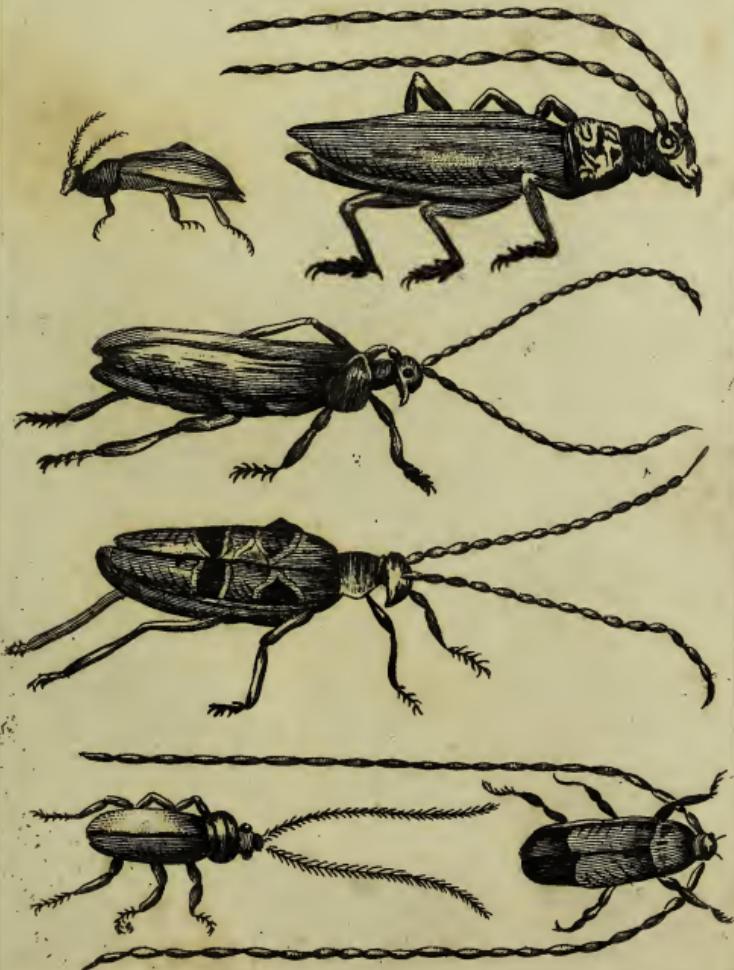


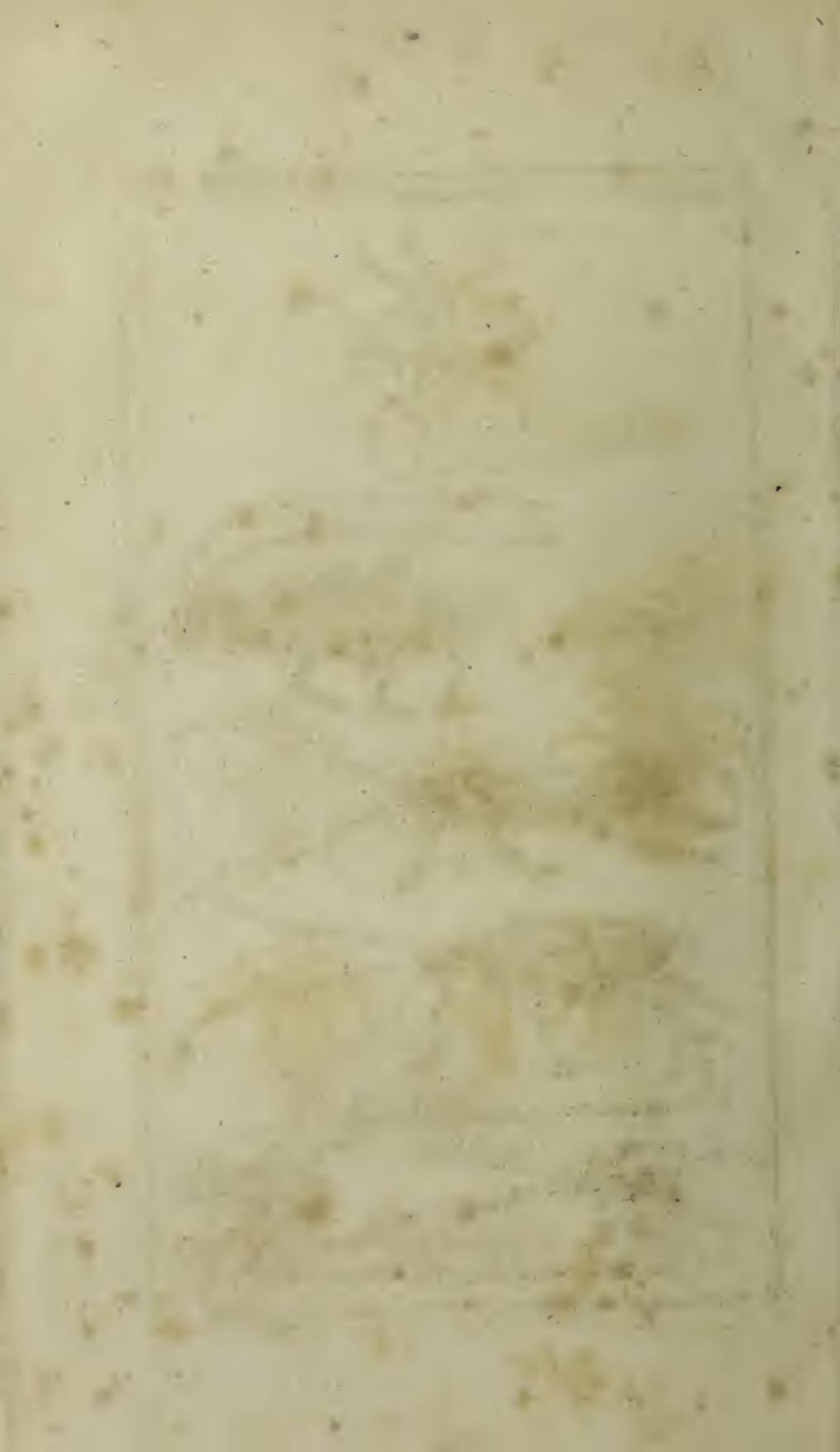


Pill Beele.



Capricorn Beetles.





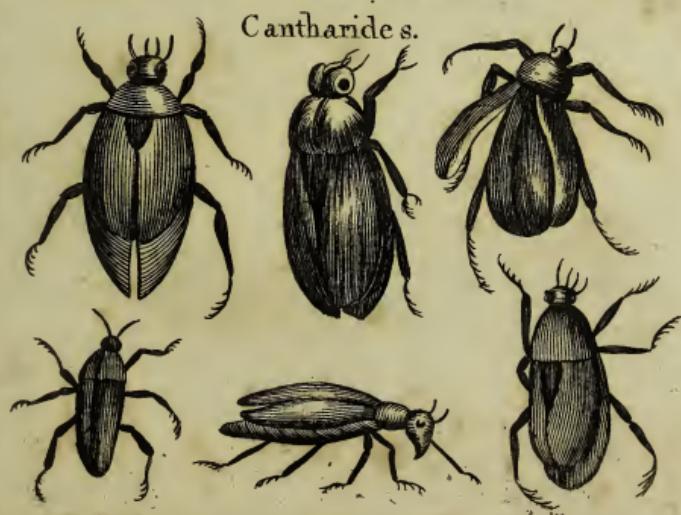
The Cicindela,
of Mousset.

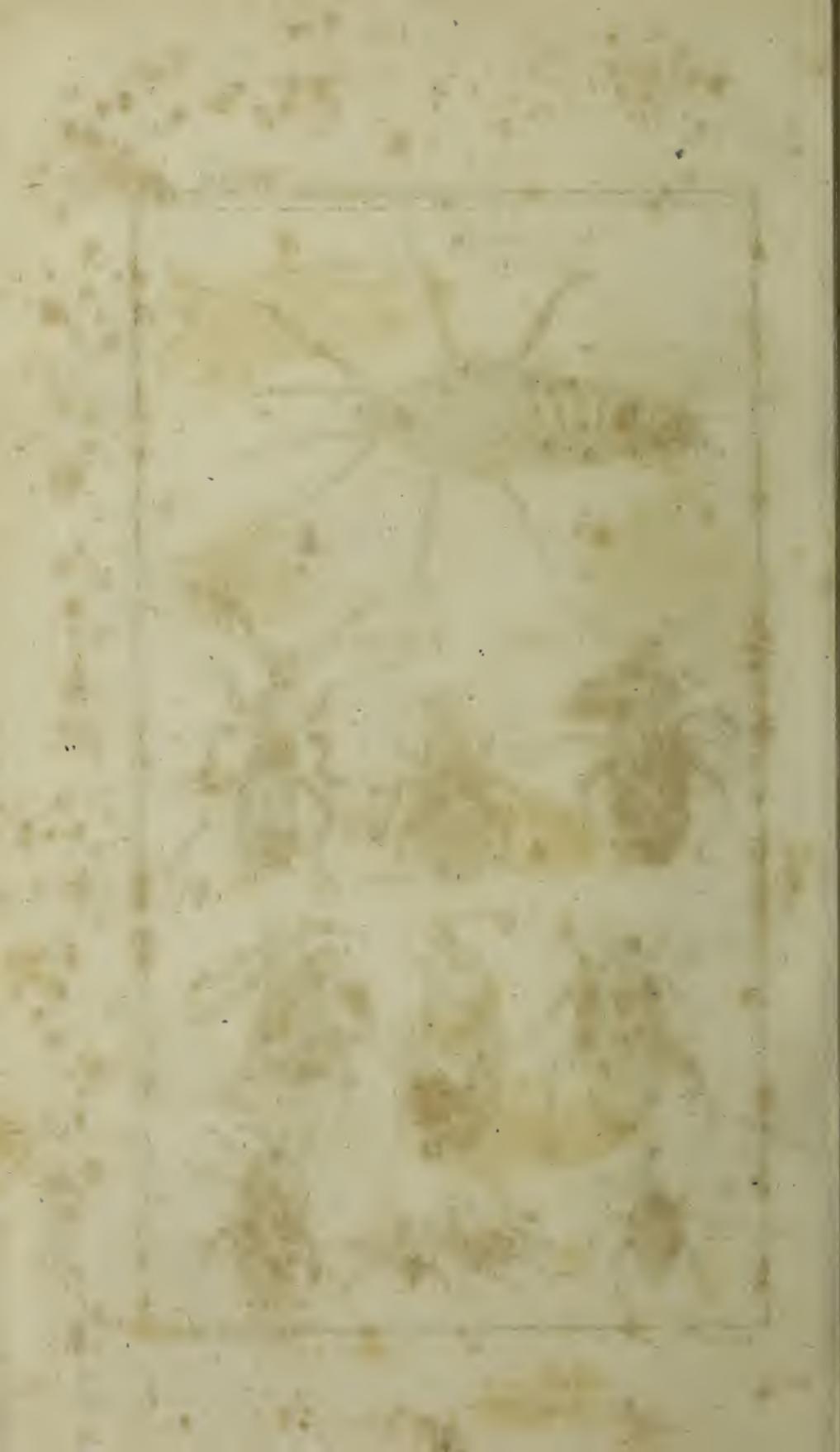


Gadflies or Burncows.



Cantharide s.

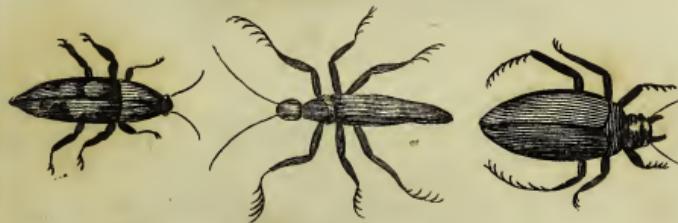




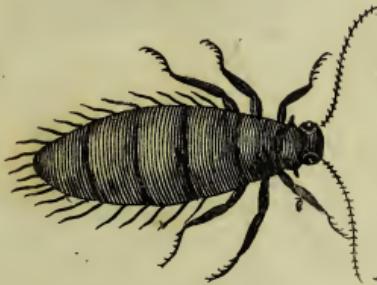
Green Chafers.



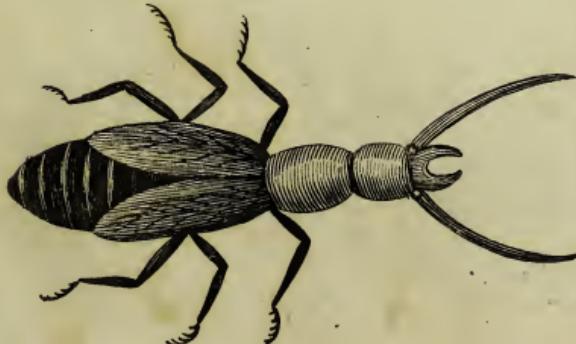
Small Beetles.



Oil Beetle.



A Pro-Scarabee.







Field Cricket.



Crickets.

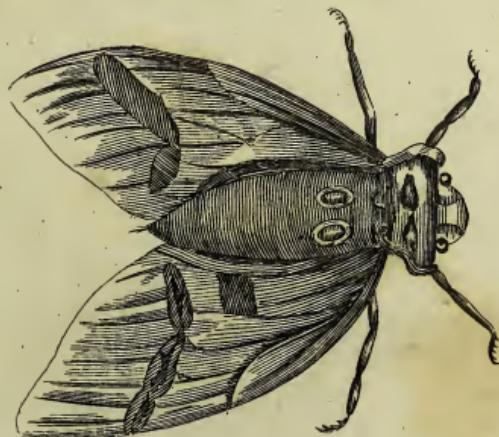
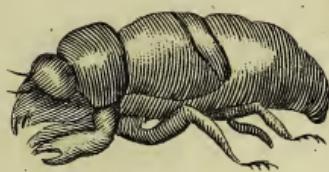


Water Crickets.



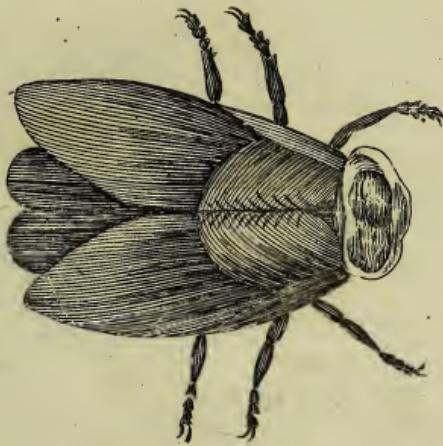


A sort of Graftshopper.





A sort of Graftshopper.



Locusts.





Locusts





Three Cicindelæ.



Mill Beetle.



Two Crane Flies
a Sort of Tabellulæ.



Mill Beetle
without wings.



The Reverse.

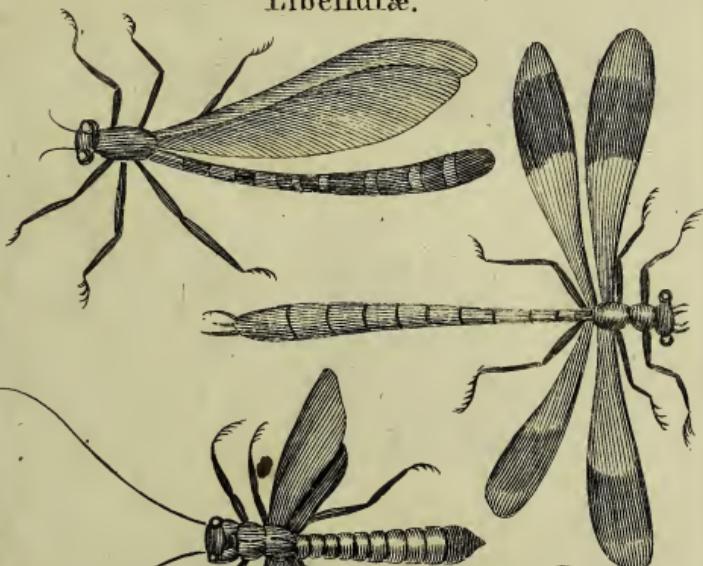




Tailed Fly.



Libellulæ.



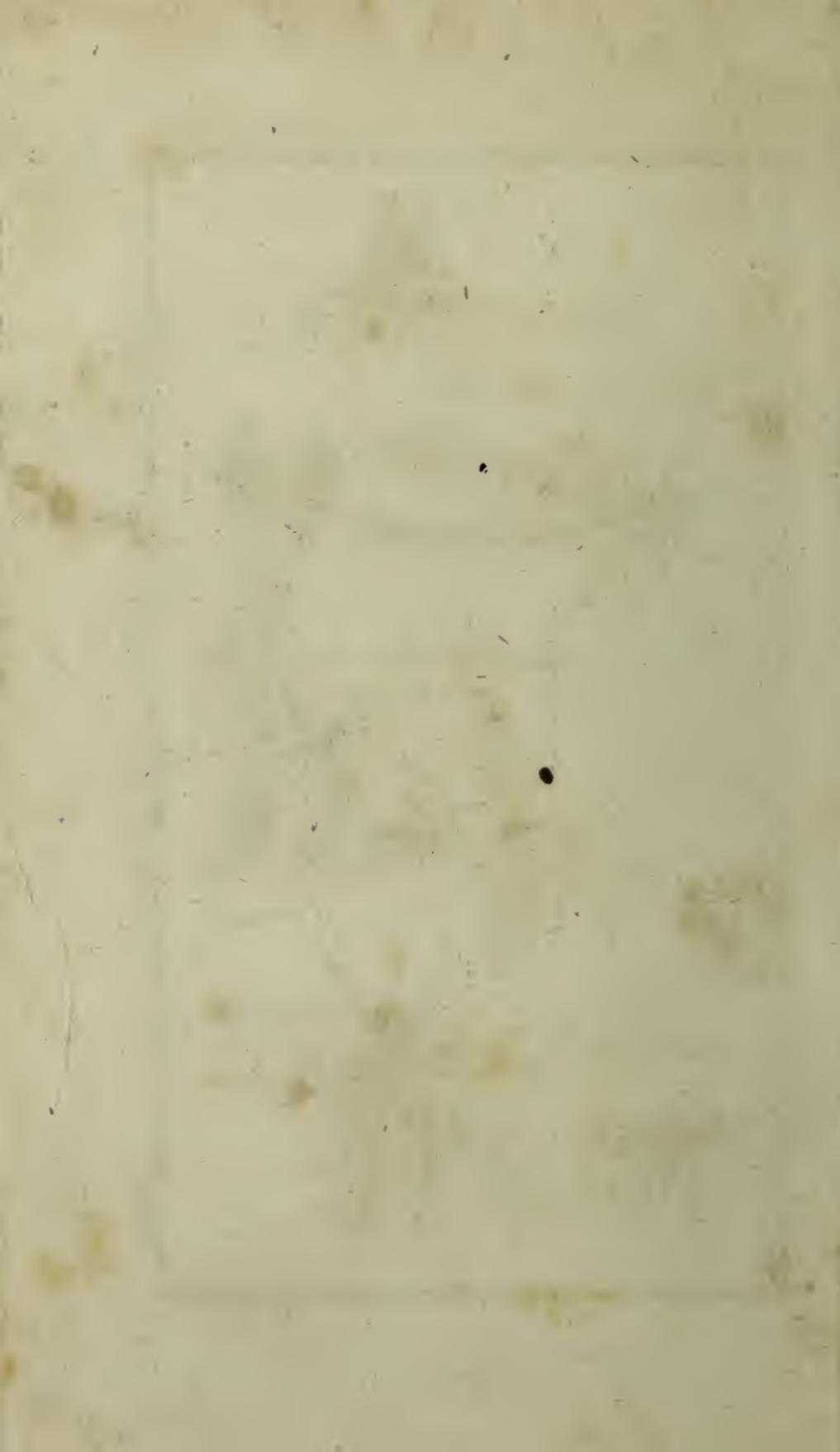
Plumed Moth.



Crane Fly

a sort of
Libellula.



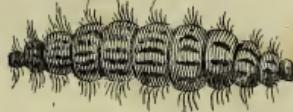


Burnet Moth.



Chrysalis.

Caterpillar.



Common Butterfly.



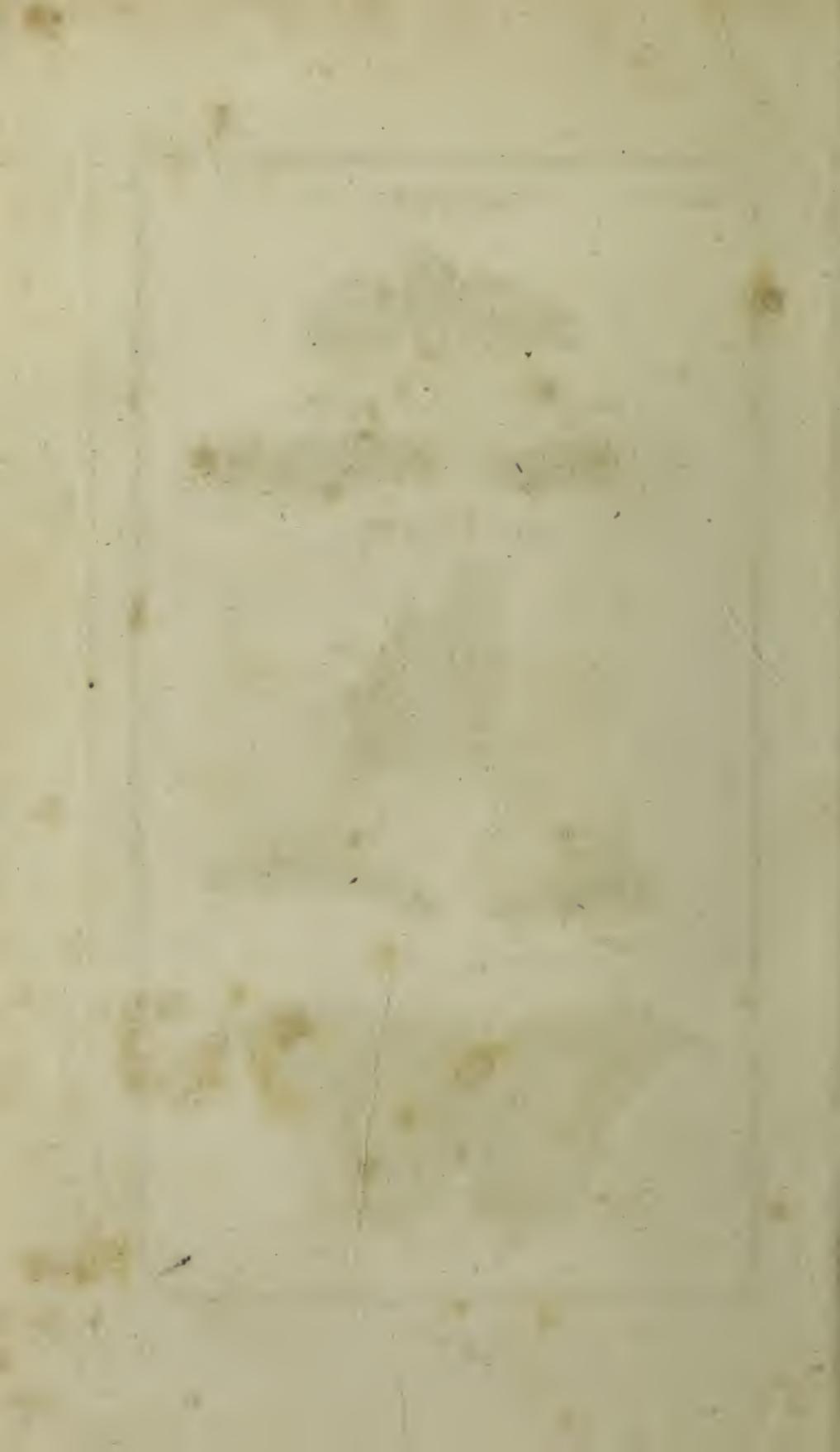
Chrysalis.

Caterpillar.



Great Butterfly.





The Black Butterfly of the West Indies.



The Black and White Butterfly from China.

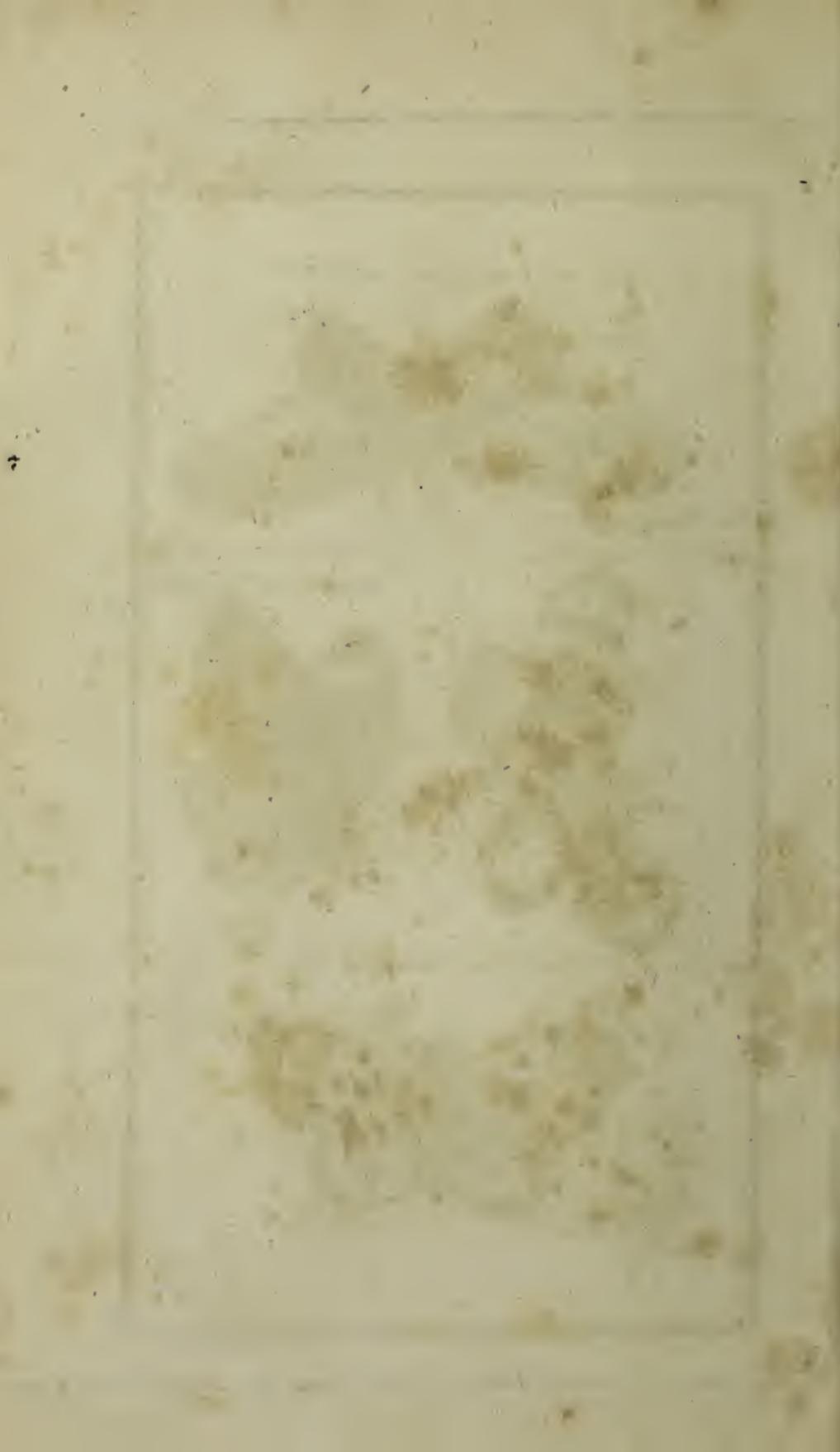


The Transparent Wing'd Butterfly of y^e West Indies.



The Yellow Butterfly of China.





Drone.



Queen Bee.



Working Bee.



Female.



Female.



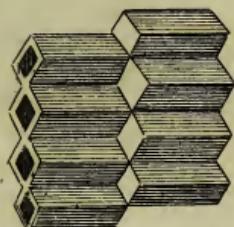
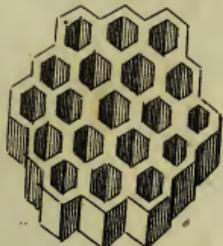
Working Wasp.



Male.

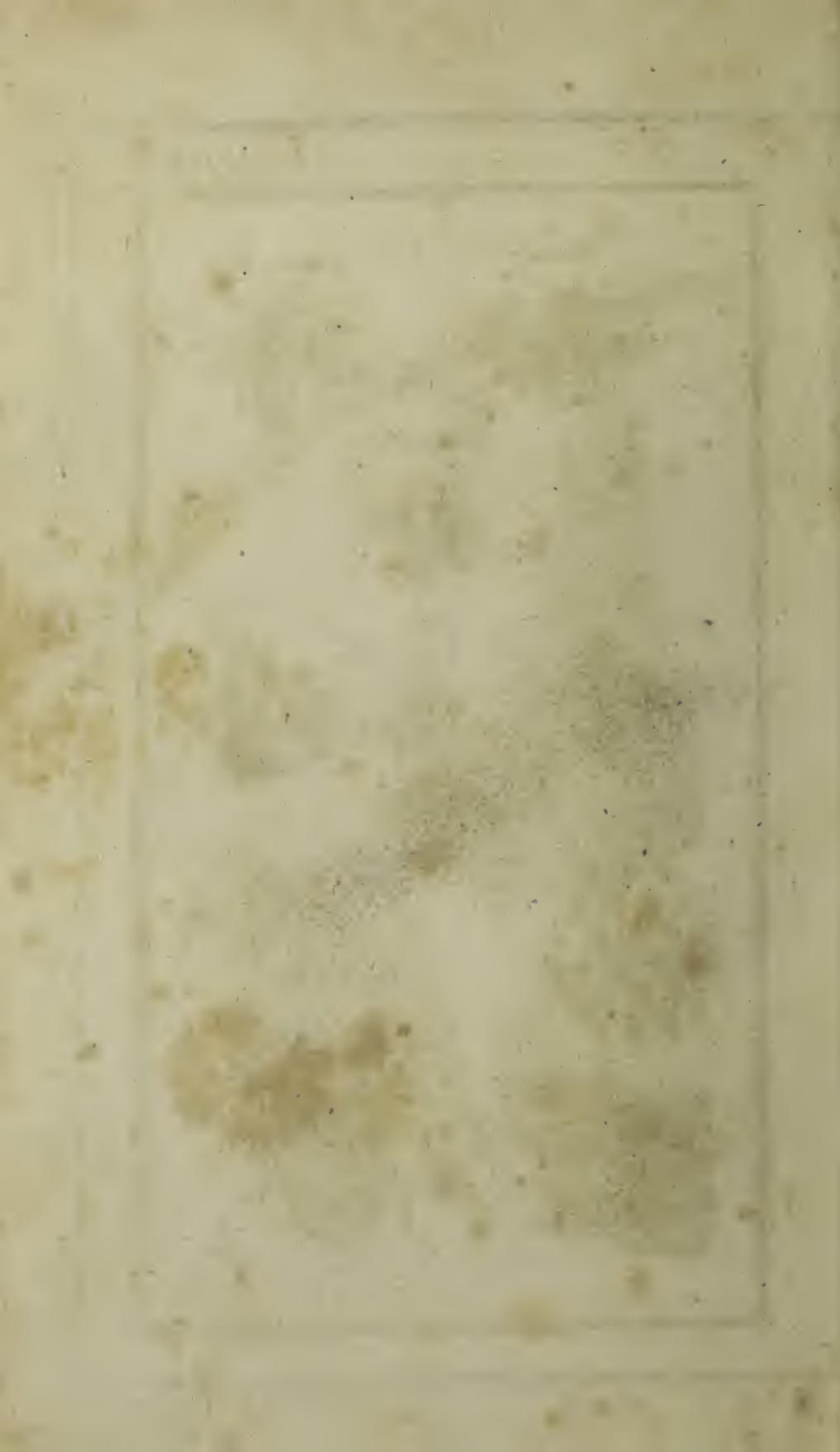


Comb.

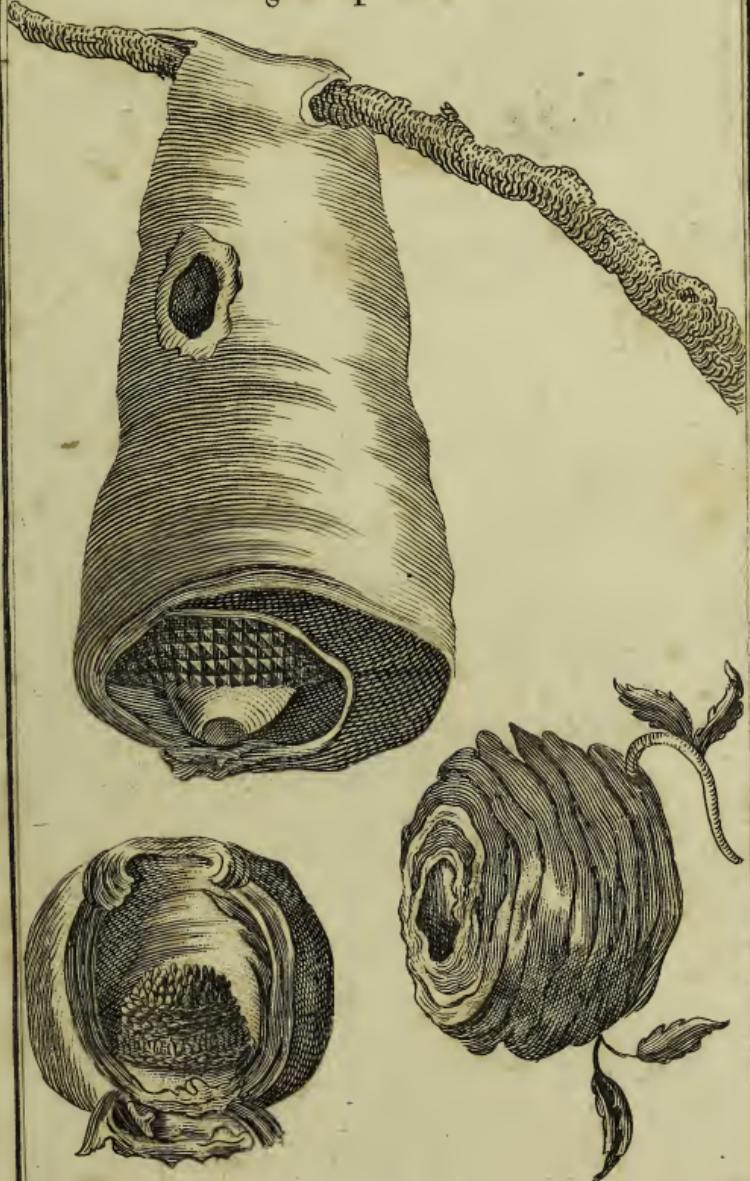


Humble Bee.





Foreign Wasps Nests.





Two Horse Flies.



The Horse Fly of the West Indies.



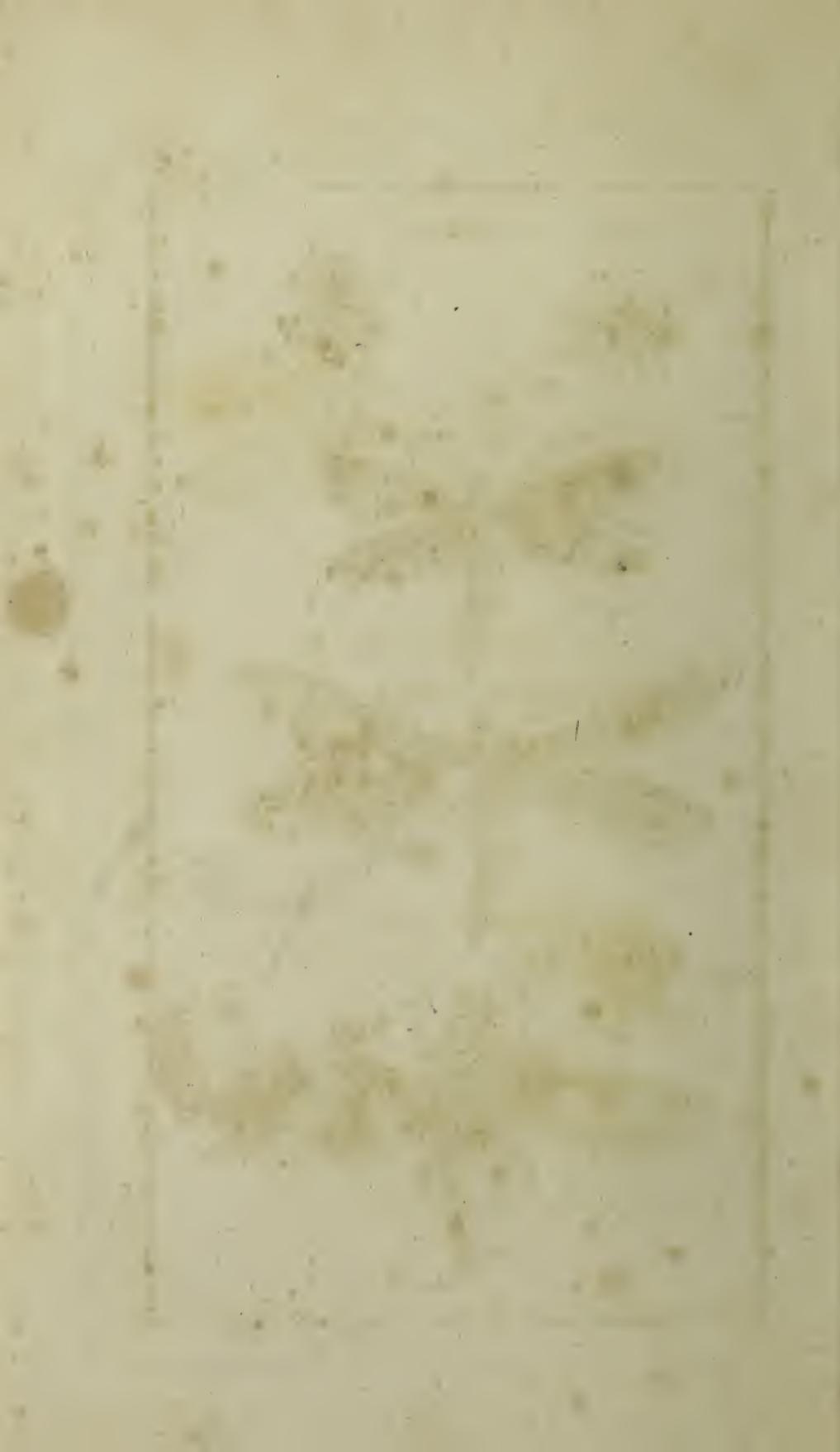
The Green Horse Fly of China.



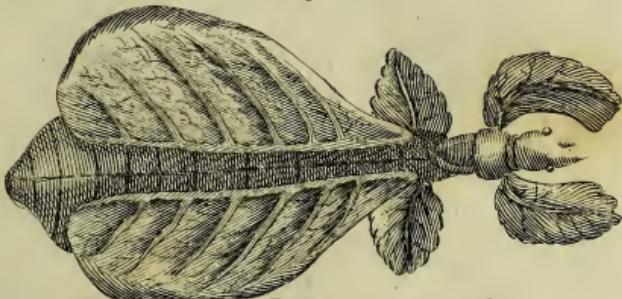
Fire

Fly.

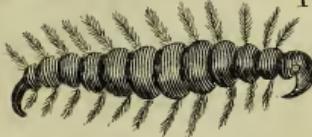




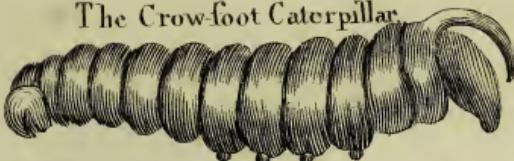
The Walking Leaf.



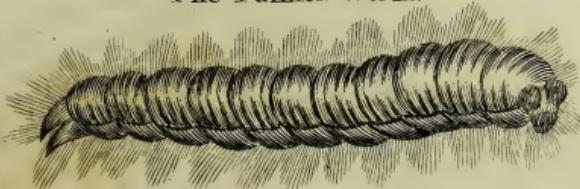
The Nettle Catterpillar.



The Crow-foot Caterpillar.

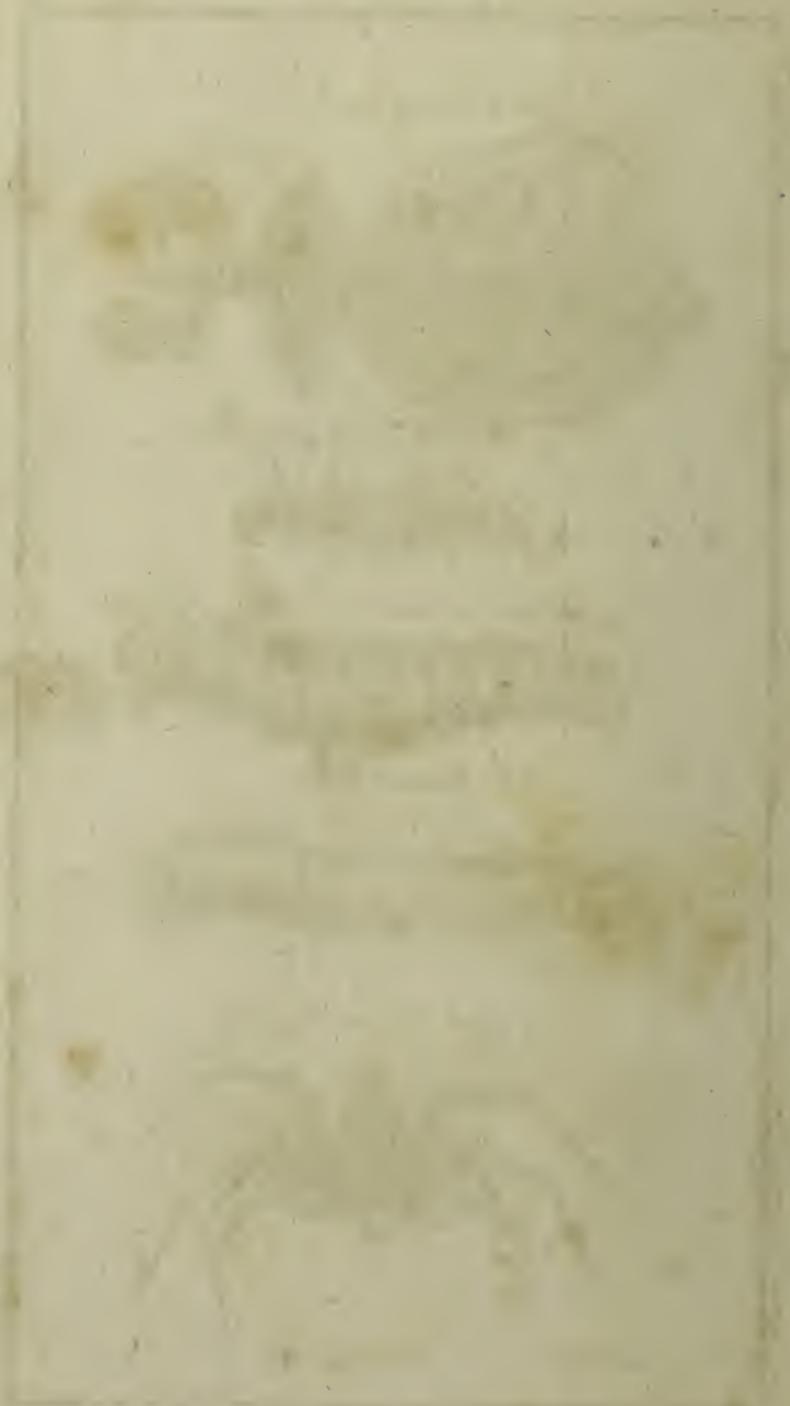


The Palmer Worm.



West Indian Spider.





Reddish black
Earth Spider.



Grey Spider.



Field Spider.



Large Web Wearing Spider.



American Spider.



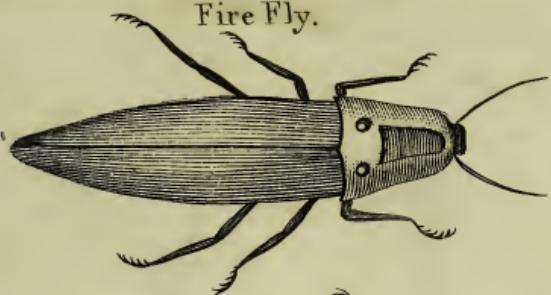
Spotted

Elsex Spider.

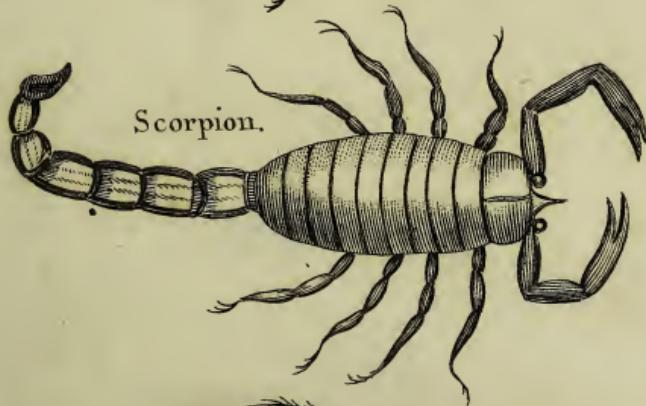




Fire Fly.



Scorpion.



Phalangium.



Centipee.





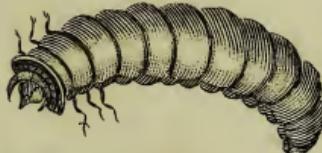
Water Insects.



Water Pulices.



Timber Worm.



Horse Leech.

